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Beginning with this issue, page layout for *STAR* is being accomplished entirely by computer. As a result, accession numbers now run in unbroken sequence through the issue, without regard to category assignment. It is no longer necessary to refer to a category number to locate an item in the abstract section.

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INTRODUCTION

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Volume 9 Number 21 / November 8, 1971

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page:

01 AERODYNAMICS
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion. **3373**

02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **3374**

03 AUXILIARY SYSTEMS
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **3378**

04 BIOSCIENCES
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **3380**

05 BIOTECHNOLOGY
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. **3383**

06 CHEMISTRY
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **3385**

07 COMMUNICATIONS
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **3389**

08 COMPUTERS
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics. **3397**

09 ELECTRONIC EQUIPMENT
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. 3402

10 ELECTRONICS
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories. 3405

11 FACILITIES, RESEARCH AND SUPPORT
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. 3406

12 FLUID MECHANICS
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. 3409

13 GEOPHYSICS
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. 3414

14 INSTRUMENTATION AND PHOTOGRAPHY
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. 3424

15 MACHINE ELEMENTS AND PROCESSES
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection. 3431

16 MASERS
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State. 3435

17 MATERIALS, METALLIC
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics. 3437

18 MATERIALS, NONMETALLIC
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. 3442

19 MATHEMATICS
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers. 3445

20 METEOROLOGY
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. 3450

21 NAVIGATION
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. 3455

22 NUCLEAR ENGINEERING
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. 3456

23 PHYSICS, GENERAL
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation. 3463

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation. 3466

25 PHYSICS, PLASMA
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems. 3493

26 PHYSICS, SOLID-STATE
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics. 3496

27 PROPELLANTS
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems. 3501

28 PROPULSION SYSTEMS
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants. 3501

29 SPACE RADIATION
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear. 3503

30 SPACE SCIENCES
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 3506

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. **3512**

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. **3526**

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. **3529**

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents. **3532**

SUBJECT INDEX I-1

PERSONAL AUTHOR INDEX I-67

CORPORATE SOURCE INDEX I-75

CONTRACT NUMBER INDEX I-89

REPORT/ACCESSION NUMBER INDEX I-93

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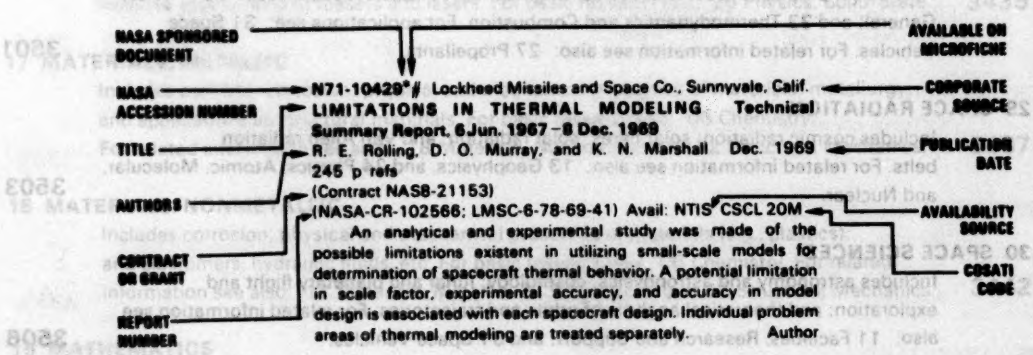
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TITLE
LIMITATIONS IN THERMAL MODELING Technical Summary Report, 6 Jun. 1967 - 8 Dec. 1969
AUTHORS
R. E. Rolling, D. O. Murray, and K. N. Marshall Dec. 1969
PUBLICATION DATE
245 p refs
(Contract NAS8-21153)
(NASA-CR-102566; LMSC-6-78-69-41) Avail: NTIS CSCL 20M
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An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author
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VOLUME 9 NUMBER 21 / NOVEMBER 8, 1971

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-34001*# North American Rockwell Corp., Los Angeles, Calif.
ESTIMATED PERFORMANCE AND STABILITY AND CONTROL DATA FOR CORRELATION WITH XB-70-1 FLIGHT TEST DATA
John H. Wykes and Robert E. Lawrence Jul. 1971 491 p refs
(Contract NAS2-6037)
(NASA-CR-114335) Avail: NTIS CSCL 01B

The results of a study program established by NASA to provide supporting information for correlation studies based on small-scale rigid-model wind tunnel test data and results from flight tests of the XB-70-1 airplane are reported. The ultimate objective of the overall program is to validate with flight results combined analytical and wind tunnel test techniques for determining performance, stability, and control characteristics of flexible aircraft. Author

N71-34002# Royal Netherlands Aircraft Factories Fokker, Amsterdam.
T-TAIL AEROELASTIC ANALYSIS FOR FOKKER F-28
J. Yff and R. J. Zwaan [1970] 22 p refs Presented at the AGARD Symp. for Unsteady Aerodynamics for Aeroelastic Analyses of Interfering Surfaces, Tonsberg, Oslofjorden, Norway, 3-4 Nov. 1970
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The experimental aeroelastic analysis of the T-tail configuration of the F-28 transport aircraft is discussed. The construction of the tail surfaces is described and the results of wind tunnel tests are presented. The influence of rudder-stabilizer interference effects on the T-tail flutter is emphasized. P.N.F.

N71-34003# Royal Inst. of Tech., Stockholm (Sweden). Dept. of Aeronautical Engineering.
ON THE INDUCED DRAG OF THIN PLANE DELTA WINGS. AN EXPERIMENTAL STUDY OF THE SPANWISE DISTRIBUTION OF THE LEADING EDGE FORCES AT LOW SPEEDS
Sven-Olof Ridder May 1971 56 p refs
(KTH-Aero-TN-57) Avail: NTIS

The induced drag characteristics of three 60 degree delta wings of identical planform but with different leading edge radius spanwise distributions were investigated in a low speed wind tunnel. Of the wings tested the one with a constant leading edge radius along the edge gives the widest C sub L-range for low induced drag. The spanwise distribution of the local leading edge forces has been measured by means of a separate leading edge panel element mounted on a sensitive strain gauge balance. Author

N71-34004*# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
A SECOND ORDER SLENDER WING THEORY FOR WINGS WITH LEADING EDGE SEPARATION IN SUPERSONIC FLOW
Joseph P. Nenni and Chee Tung Washington NASA Sep. 1971 65 p refs
(Contract NAS1-9543)
(NASA-CR-1860; AF-2883-S-1) Avail: NTIS CSCL 01A

A second order slender wing theory was developed for calculating the supersonic flow over low aspect ratio wings with subsonic leading edges and leading edge separation. The theory is second order in terms of the ratio of span to chord. The theory was developed by using a combined application of the method of strained coordinates and matched asymptotic expansions. The Brown and Michael flow model was used to model the leading edge separation. The theory is compared with experiment for delta wings and provides a substantial improvement over previous slender wing results but still overestimates normal force. The theory qualitatively predicts the correct Mach number trend and approaches the correct level for a sonic leading edge. The trend is somewhat overpredicted, however, producing best agreement at the higher Mach numbers. Author

N71-34005# National Aerospace Lab., Tokyo (Japan).
DEVELOPMENT OF THE FA-200XS EXPERIMENTAL AIRPLANE
1970 30 p refs In JAPANESE; ENGLISH summary
(NAL-TR-229) Avail: NTIS

The FA-200XS is an experimental plane being developed to investigate the operational problems of STOL type airplane. The plane is generally similar to the original FA-200 (Aerobatic Category Certification) light airplane, but is equipped with full span slats and flaperons, as well as a boundary layer control system using distributed area suction located on the leading edges of flaps and ailerons. The experiments for the developments consisted of 2- and 3-dimensional wind tunnel tests, and several series of flight tests to investigate the aerodynamic characteristics of the FA-200X and FA-200XS. Author

N71-34006# Brussels Univ. (Belgium).
AERODYNAMIC PROPERTIES OF A FLEXIBLE BLADE GRID [PROPRIETES AERODYNAMIQUES D'UNE GRILLE

D'AUBES FLEXIBLES]
Charles Hirsch 1969 160 p refs In FRENCH
(NT-21) Avail: NTIS

Theoretical and experimental determination of flexible wing profile deformation are presented. Calculations were made using variable flexible blade grids and changing Reynolds numbers. Graphs and charts are included. Results indicate theoretical and experimental calculations are in good agreement with each other. Transl. by E.H.W.

N71-34007*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TRANSONIC AERODYNAMIC CHARACTERISTICS OF THE VIKING ENTRY AND LANDER CONFIGURATIONS
Robert J. Mc Ghee, Paul M. Siemers, III, and Richard E. Pelc Washington Sep. 1971 52 p ref
(NASA-TM-X-2354; L-7849) Avail: NTIS CSCL 22B

A wind-tunnel investigation of 0.08-scale models of the proposed Viking spacecraft configuration has been conducted to determine the subsonic and transonic aerodynamic characteristics. Force and moment data were obtained on the entry vehicle, the aeroshell, and the lander plus base cover. In addition, pressure distributions on the lander plus base cover were obtained at model roll angles of 0 deg, -60 deg, -120 deg, and -180 deg. The investigation was conducted at Mach numbers from 0.40 to 1.20 for an angle-of-attack range from about -1 deg to 24 deg. The Reynolds number, based on maximum body diameter, varied from .74 million and 1.84 million. Author

N71-34008*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HYPERSONIC AERODYNAMIC CHARACTERISTICS OF A VARIABLE-DIHEDRAL DELTA-WING SPACECRAFT CONFIGURATION
James C. Ellison and Bernard Spencer, Jr. Washington Sep. 1971 21 p refs
(NASA-TM-X-2391; L-7752) Avail: NTIS CSCL 22B

An investigation of a variable-dihedral delta-wing spacecraft concept has been conducted in a hypersonic flow apparatus at a Mach number of 10.03. Angle of attack was varied from -5 deg to about 38 deg at angles of sideslip of 0 deg and -5 deg. Static longitudinal and lateral-directional characteristics were investigated for wing dihedral angles of 0 deg, 30 deg, 60 deg, 90 deg, and 110 deg for both 0 deg and 13 deg of wing toe-in. Author

N71-34009*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTIC STUDIES OF SOUND PRESSURES INSIDE THE DUCT OF DUCTED PROPELLERS
Joseph A. Drischler Washington Sep. 1971 40 p refs
(NASA-TN-D-6345; L-7378) Avail: NTIS CSCL 01A

The sound-pressure field of a rotating ducted propeller in forward flight is analyzed by replacing the duct by an infinite coaxial circular cylinder and assuming that the bladeloading distribution associated with the thrust and the torque can be represented by a distribution of acoustic pressure doublets acting at the propeller disk. Trend studies are made to ascertain the effect on the pressure distribution inside the duct of variations in propeller loading, tip clearance, free-stream Mach number, tip Mach number, and hub-tip ratio. The effect on the pressure distribution of concentrating the loading at various radial positions on the propeller blade is also investigated. Author

N71-34010 Princeton Univ., N.J.
NONLINEAR FLUTTER OF CLAMPED PLATES
Charles Samuel Ventres (Ph.D. Thesis) 1970 172 p
Avail: Univ. Microfilms Order No. 70-19807

The nonlinear flutter behavior of clamped plates exposed to transverse and/or in-plane loads is studied theoretically, and the results compared with published experimental data. Galerkin's method is used to transform the Von Karman plate equations into a set of nonlinear ordinary differential equations. These are integrated numerically to study both the stability of the plate and the nature of its limit cycle (flutter) motion. To explore the influence of the in-plane boundary conditions satisfied at the edges of the plate, equations of motion are derived for plates with and without in-plane edge restraint. Quasi-steady aerodynamic theory is employed for the experimental correlations, although equations of motion employing full linearized potential flow theory are also developed. Measurements of the natural frequencies of a panel exposed to a static pressure differential are described and discussed. Comparisons are made between calculated and measured flutter boundaries of plates exposed to static pressure differentials, and for plates buckled by in-plane loads due to thermal expansion. Dissert. Abstr.

N71-34011 California Univ., Los Angeles.
A MONTE CARLO NUMERICAL EXPERIMENT APPLIED TO TURBULENT FAR WAKES
Arthur Widawsky (Ph.D. Thesis) 1970 257 p
Avail: Univ. Microfilms Order No. 70-19916

A mathematical model of the turbulent far wake can be set up in terms of exchange coefficients which, when multiplied by the velocity or enthalpy difference between two regions in the wake, yield the momentum or energy exchange between the regions. The exchange coefficients decrease exponentially with the distance between the two regions. Two dimensional wakes are divided into layers, while axisymmetric wakes are divided into annuli. The standard deviation of the fluctuations of these layers or annuli is the single parametric function to be prescribed. This is done with the guidance of existing experimental data. With the standard deviation of the fluctuations prescribed, the details of the far wake, such as mean values and root mean square fluctuations of velocity, are obtained. The wakes behind a circular cylinder, a sphere, and a disk were studied. A different set of standard deviations was found for each of these geometries. The results were seen to be independent of the free stream Reynolds number. Dissert Abstr.

N71-34012 Stanford Univ., Calif.
A TRAILING-EDGE CORRECTION FOR SUBSONIC SLENDER-WING THEORY
Robert Sugden Rogallo (Ph.D. Thesis) 1970 58 p
Avail: Univ. Microfilms Order No. 70-18463

Slender wing theory, the asymptotic lifting surface theory for small aspect ratio, is a singular perturbation problem and exhibits nonuniformities wherever its first-order chordwise loading is nonanalytic. The most useful example is the straight trailing edge, normal to the undisturbed free stream, located at the station of maximum span. The trailing edge nonuniformity is analyzed using the method of matched asymptotic expansions. Universal corrector potential problems are formulated but not solved. The dependence of the lift upon aspect ratio and planform geometry is given explicitly and the universal constants required are estimated by using Lawrence's theory of slender wings as a model of the full problem. Dissert. Abstr.

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-34013*# United Aircraft Corp., East Hartford, Conn.
APPLICATION OF BORON/EPOXY REINFORCED ALUMINUM STRINGERS FOR THE CH-54B HELICOPTER TAIL

CONE. PHASE 1: DESIGN, ANALYSIS, FABRICATION AND TEST Final Report, Feb. - May 1971
R. T. Welge Jul. 1971 126 p refs
(Contract NAS1-10459)
(NASA-CR-111929) Avail: NTIS CSCL 01C

A preprototype study is presented of the CH-54B tail cone in which component fabrication, testing, and analysis was done, and the strength adequacy of boron/epoxy reinforced members was verified. The vertical stiffness of the CH-54B tail cone was maintained with an approximate 70 per cent saving in stiffening weight by the application of boron/epoxy reinforced stringers. The boron/epoxy stringer reinforcement was configured such that the stiffness of the current production aluminum tail cone was achieved with minor changes. A boron/epoxy strip 0.750 x 0.250 inches was bonded to the vertical legs of the standard aluminum stringers. A joint analysis detailed the end taper of the boron/epoxy reinforcement necessary to reduce the peak shear stresses. Conventional and boron reinforced panels were fabricated and comparative shear and compression panel tests conducted. Test results indicated that the shear capability of the panels was unchanged by the presence of the boron, while the compression tests results showed the reinforced panels capable of withstanding higher loads. Of significance is the fact that an adequate bond and tapered boron/epoxy joint was achieved.
Author

N71-34014*# United Aircraft Corp., East Hartford, Conn.
CH-54B BORON/EPOXY REINFORCED TAIL CONE DETAILED STRUCTURAL SUBSTANTIATION Final Report
D. W. Lowry and S. Ciardullo Jul. 1971 381 p refs
(Contract NAS1-10459)
(NASA-CR-111930) Avail: NTIS HC $6.00/MF $0.95 CSCL 01C

A detailed structural analysis was made of the tail cone and transition section of the CH-54B helicopter reinforced with boron/epoxy stringers. A conservative analytical approach was used in that the analysis for the critical flight conditions included the assumptions of no stringer reinforcement, and partial stringer reinforcement. Positive margins of safety were shown in all conditions. The boron/epoxy reinforced stringers necessitated minor tail cone modifications and the structural stiffness of the current CH-54B tail cone was maintained.
Author

N71-34015*# National Aeronautics and Space Administration, Washington, D.C.
REPORT OF THE COMMITTEE FOR AIR TRANSPORT ON PLAN 6 [RAPPORT DU COMITE DES TRANSPORTS AERIENS SUR LE 6 PLAN]
Jean Cahen-Salvador Washington NASA Sep. 1971 91 p Transl. into ENGLISH from French report
(NASA-TT-F-13947) Avail: NTIS CSCL 01B

The conclusions are summarized of studies which the French Committee for Air Transport conducted. The studies were aimed at defining proposals and recommended directions in the air transport field for the coming five years. The material is presented in three sections that deal with (1) options, goals, and general data; (2) resources and their programming; and (3) the financial envelopes.
D.L.G.

N71-34016*# Kaman Avidyne, Burlington, Mass.
AUTOMATIC GUIDANCE FOR VTOL AIRCRAFT Final Report
William C. Hoffman Feb. 1970 170 p refs
(Contract NAS12-2097)
(NASA-CR-121768; TR-66) Avail: NTIS CSCL 01B

A simple perturbation feedback scheme is developed for automatic guidance of a VTOL aircraft with a velocity-command flight control system. By neglecting the delay required to attain a commanded velocity and by using ground range to touchdown rather than time as the independent variable, a reduced model having two state variables (altitude and crossrange) and three control variables, components of commanded velocity, was obtained. The model was linearized by taking first-order perturbations about a nominal trajectory. By minimizing a performance index which was quadratic in both the state and the control variables, an effective linear feedback guidance law was developed. The performance of the guidance concept was evaluated by means of a six-degree-of-freedom digital simulation of the YHC-1A tandem rotor helicopter with the NASA/ERC velocity-command flight control system. Simulation results indicated that the scheme can successfully handle a variety of off-nominal conditions, including initial condition errors, winds, and uncertainties in aircraft characteristics.
Author

N71-34017*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AIRFLOW CONTROL SYSTEM FOR SUPERSONIC INLETS Patent Application
Glenn A. Mitchell, inventor (to NASA) and Bobby W. Sanders, inventor (to NASA) Filed 11 Jun. 1971 10 p
(NASA-Case-LEW-11188-1; US-Patent-Appl-SN-152328) Avail: NTIS CSCL 01B

In addition to fixed and variable bleed devices provided for controlling the position of a terminal shock wave in a supersonic inlet, a plurality of free piston valves are disposed around the periphery of a cowling of a supersonic engine inlet. The free piston valves are disposed in dump passageways. Each valve begins at a bleed port in the cowling that is located in the throat region of the inlet where the diameter of the centerbody is near maximum and terminates at an opening in the cowling adjacent a free piston valve. Each valve is controlled by a reference pressure.
NASA

N71-34018# Cranfield Inst. of Technology (England).
THE PREDICTION OF EMPTY WEIGHT RATIO AND CRUISE PERFORMANCE OF VERY LARGE SUBSONIC JET TRANSPORT AIRCRAFT
D. Howe Jan. 1971 20 p refs
(Cranfield-Aero-3) Avail: NTIS

The empirical trend of the empty weight ratio of long range subsonic jet transports is analyzed in order to enable the cruise performance of very large aircraft to be predicted. Each of the main items which go to make up the empty weight is dealt with individually in order that the effect of size on each can be established. Consideration is given to the effect of increased wing loading on take off runway requirements. It is concluded that it would be feasible to produce an aircraft capable of carrying up to 1000 passengers over the great majority of all transatlantic routes. Such an aircraft would have an empty weight ratio of about 0.5 and would weigh approximately twice as much as the largest subsonic jet at present in existence.
Author

N71-34019# Loughborough Univ. of Technology (England). Dept. of Transport Technology.
A SOCIAL SURVEY INTO ANNOYANCE CAUSED BY THE INTERACTION OF AIRCRAFT NOISE AND TRAFFIC NOISE
C. G. Bottom and D. M. Waters [1971] 15 p refs
(TT-7102) Avail: NTIS

The procedure which was adopted to investigate the community response to combined noise from aircraft and road traffic is described. A social survey was conducted at nine sites at three levels of aircraft and traffic noise with thirty-five interviews per site. The mean results without regard to traffic noise level show good agreement with previous data, but there are significant variations with respect to traffic noise level. The use of the noise pollution level concept, which describes the noise climate as a function of mean energy level and the standard deviation of sound level, leads to strong correlation and median dissatisfaction with the total noise environment.
Author

N71-34020 International Civil Aviation Organization, Montreal (Quebec).
AIRWORTHINESS COMMITTEE, NINTH MEETING
1971 112 p Meeting held at Montreal, 16 Nov. - 4 Dec.

1970
(DOC-8925; AIR-C-9) Copyright. Avail: Issuing Activity

Agenda items for the International Civil Aviation Organization's Ninth Meeting of the Airworthiness Committee included: review of progress on the development of acceptable means of compliance and provisional acceptable means of compliance; STOL and VTOL aircraft; airplane performance problems; provisions to enable aircraft to withstand bird strikes; crash survival; airworthiness aspects of Resolution A17-17 of the 17th Session of the Assembly; exchange of views items; preparation of a revised work program, work to be done, and assignment of tasks to members; and consideration of a need for a tenth meeting including, as necessary, proposals for a tentative agenda. Committee actions and recommendations on the agenda items are included. J.G.M.

N71-34021# Boeing Scientific Research Labs., Seattle, Wash. Aerodynamics and Marine Sciences Lab.
GLOBAL DISPERSION OF SUPERSONIC TRANSPORT EXHAUST IN THE STRATOSPHERE
C. Berman and A. Goldberg Jul. 1971 21 p refs
(D180-12981-1) Avail: NTIS

Calculations were made for the possible peak regional concentration of supersonic civil transport fleet exhaust emissions into the stratosphere. The heaviest traffic occurs in the Northern Hemisphere zone. Peak concentrations are reduced from those levels calculated for the assumption of an atmosphere with zero motion by moderating effects of zonal winds and interzonal turbulent diffusion. For a diffusion coefficient of 2 x 10 to the 9th power sq cm/sec, the regional peak value for the global dispersion of supersonic civil transport exhaust is a factor of 1.68 greater than a world average based on a uniform distribution. Author

N71-34022*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE INFLUENCE OF VERTICAL WIND GRADIENTS ON THE LONGITUDINAL MOTION OF AIRPLANES
Joseph Gera Washington Sep. 1971 19 p refs
(NASA-TN-D-6430; L-7671) Avail: NTIS CSCL 01B

An assessment of the influence of wind shear on the longitudinal motion of airplanes is presented. It was assumed that the wind is completely horizontal and its speed varies linearly with altitude. It is shown quantitatively that both glide and climb performance are influenced by wind shear and that trimmed flight at constant airspeed, attitude, and with fixed controls is along a parabolic path relative to the ground. The problem of the landing approach in a wind shear is examined in some detail. Small-disturbance theory indicates no wind-shear effect on the short-period motion and the time for the phugoid to damp to half amplitude but the phugoid frequency and damping ratio vary considerably with wind shear. A nondimensional quantity which depends on the wind shear and airspeed is shown to be a fundamental parameter influencing the longitudinal dynamic behavior of the airplane. Author

N71-34023# Defense Documentation Center, Alexandria, Va.
ENVIRONMENTAL POLLUTION: NOISE POLLUTION, SONIC BOOM, VOLUME 1 Bibliography Report, Apr. - Jul. 1970
Apr. 1971 86 p refs
(AD-722910; DDC-TAS-71-9-1) Avail: NTIS CSCL 20/1

The unclassified, annotated bibliography is Volume I of a two-volume set on Noise Pollution - Sonic Boom in a series of scheduled bibliographies on Environmental Pollution. Volume II is Confidential. Corporate author-monitoring agency, subject, title, contract, and report number indexes are included.
Author (GRA)

N71-34024# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
AIRCRAFT GROUND FLOTATION ANALYSIS PROCEDURES: PAVED AIRFIELDS Technical Report, Jan. - May 1969
Dale E. Creech and Donald H. Gray Jan. 1971 56 p refs Supersedes SEG-TR-67-52; N68-31777
(AD-720273; ASD-TR-70-43; SEG-TR-67-52) Avail: NTIS CSCL 01/2

The report describes standardized methods for analyzing ground flotation characteristics for aircraft of various designs based on the type of airfield construction. The methods described were applied in an analysis of the KC-135 aircraft to illustrate the techniques. These methods can be applied to any aircraft to determine its flotation characteristics in relation to a given type runway. Author (GRA)

N71-34025*# Litchford Systems, Northport, N.Y.
AERONAUTICS AND AIR TRAFFIC CONTROL
G. B. Litchford Washington NASA Aug. 1971 198 p (Contract NASw-1849)
(NASA-CR-1833) Avail: NTIS CSCL 01B

A study and evaluation is made of the broad aspects of air traffic control and its relationship to the future of aeronautics. Present ATC techniques of controlling air traffic primarily by ground personnel are compared with new concepts wherein the pilot becomes a more active participant in the air traffic control process. Adequate progress in ATC cannot be expected until far better testing, validation, and design tools become available. Some candidates for new national facilities for testing various aspects of ATC and related aeronautics are identified. ATC technology in its broadest sense is essentially emerging as a new professional area. New programs and courses in ATC technologies are needed in curricula of colleges and universities to produce sufficient numbers of qualified graduates. Improved communications between the diverse disciplines impacting ATC progress is essential. Often a given government agency represents but a few of the many disciplines involved. It is urged that an improvement in the application of the total government resources in ATC technology be made. The fractional elements within government, industry, and the universities required for the solution of ATC technology can be brought together and focused on a progressive national solution. Author

N71-34026*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
HIGH-ALTITUDE FLIGHT TEST OF A REEFED 12.2-METER-DIAMETER DISK-GAP-BAND PARACHUTE WITH DEPLOYMENT AT A MACH NUMBER OF 2.58
John S. Preisser and R. Bruce Grow Washington Sep. 1971 65 p refs Technical Film Supplement L-1106 available on request
(NASA-TN-D-6469; L-7772) Avail: NTIS CSCL 01C

A reefed 12.2-meter nominal-diameter (40-ft) disk-gap-band parachute was flight tested as part of the NASA Supersonic High Altitude Parachute Experiment (SHAPE) program. A three-stage rocket was used to drive an instrumented test payload to an altitude of 43.6 km (143,000 ft) and a Mach number of 2.58 where the parachute was deployed by means of a mortar. After a time delay of about 8.5 seconds, the parachute was disreefed at a Mach number of 0.99. An analysis of parachute inflation, drag, and stability for both the reefed and unreefed parts of the test are reported. In addition, detailed descriptions of the test parachute, the reefing system, and the parachute packing procedure are included. Author

N71-34027*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE ELASTIC RESPONSE OF BIAS-PLY AIRCRAFT TIRES TO BRAKING FORCES
John A. Tanner, John L. McCarty, and Sidney A. Batterson Washington Sep. 1971 31 p refs
(NASA-TN-D-6426; L-6605) Avail: NTIS CSCL 01B

The elastic behavior of a braked rolling tire and relation of this behavior to the tire characteristics obtained from simple static flexure tests are discussed. The study consisted of static

and braked-rolling tests of two types of bias-ply aircraft tires and an analysis which related tire reaction to the braking forces. The elastic response of an aircraft tire to braking forces can be defined by the displacement distribution along the tire periphery and by the fore-and-aft spring constant. Changes in the rolling radius due to braking can be predicted with reasonable accuracy from elastic measurements of the static free-tread periphery or from elastic measurements within the footprint during low-speed braking, assuming there is no slippage between the tire and the pavement. The results of these tests further indicate that what was heretofore considered as pure tire slippage under braked-rolling conditions may be wholly or in part the result of tire elasticity. The elasticity must be considered in the design or application of efficient automatic braking systems. Author

N71-34028*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
WIND-TUNNEL INVESTIGATION OF AN EXTERNAL-FLOW JET-FLAP TRANSPORT CONFIGURATION HAVING FULL-SPAN TRIPLE-SLOTTED FLAPS
Lysle P. Parlett, H. Douglas Greer, Robert L. Henderson, and C. Robert Carter (Army Air Mobility R and D Lab.) Washington Aug. 1971 267 p refs
(NASA-TN-D-6391; L-7730) Avail: NTIS CSCL 01A

A wind-tunnel investigation was conducted to determine the performance, static stability, and control characteristics of an external-flow jet-flap transport configuration having inboard pod-mounted engines and full-span triple-slotted flaps. Tests were made with the engines mounted clustered at 22.0 percent and 30.4 percent semispan to represent double (siamese) pods and with engines mounted at 22.0 percent and 41.7 percent semispan to represent a more spread arrangement. Tests were also made to evaluate the effectiveness of wing leading-edge blowing as a means of improving the aerodynamic efficiency of the configuration and of eliminating the large engine-out roll asymmetries that occurred for the configuration when the wing with an engine-out stalled first. Author

N71-34029# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT. ALITALIA AIRLINES MCDONNELL-DOUGLAS DC-8-62, I-DIWZ (ITALIAN REGISTRY), JOHN F. KENNEDY INTERNATIONAL AIRPORT, JAMAICA, NEW YORK, 15 SEPTEMBER 1970
28 Apr. 1971 25 p refs
(NTSB-AAR-71-9) Avail: NTIS

Alitalia Airlines Flight 618, made a hard landing at approximately 1321 EDT, September 15, 1970. The accident occurred following a localizer approach to Runway 4R. The glide slope portion of the Instrument Landing System (ILS) was inoperative. There were no fatalities. The 10 crewmembers and 146 passengers evacuated the aircraft after it came to a stop in a sandy area to the west of Runway 4R. Sixty-nine occupants, 11 of whom were hospitalized, sustained injuries. The aircraft departed the left side of the runway and as it continued in a divergent path from the runway it ground-looped to the left before coming to a stop. The fuselage split open in an area just aft of the wing. Three of the engines separated from the aircraft during the landing rollout. The National Transportation Safety Board determined that the probable cause of this accident was the use of reverse thrust in flight, contrary to published procedures, with a resultant uncorrectable high sink rate. The captain's decision to use reverse thrust and not to execute a missed approach was a reaction under stress occasioned, at least in part, by air traffic control (ATC) instructions which led to positioning the aircraft too high and too close to the runway. ATC vectored the aircraft to the final approach path under IFR conditions and in the absence of an operating ILS glide slope. Author

N71-34030# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT. TRANS INTERNATIONAL AIRLINES CORPORATION, FERRY FLIGHT 863, DOUGLAS DC-8-63F, N4863T, J. F. KENNEDY INTERNATIONAL AIRPORT, NEW YORK, 8 SEPTEMBER 1970
18 Aug. 1971 35 p refs
(NTSB-AAR-71-12) Avail: NTIS

The results of an investigation of the fatal crash of a DC-8 aircraft at Kennedy Airport, New York on September 8, 1970 are presented. The crash occurred shortly after takeoff due to loss of elevator control and eleven crew members were killed. Cause was determined to be a piece of aspalt from the eroded runway jamming the elevators. Analysis of records obtained from the flight data recorder and the voice recorder contributed to final decision regarding accident cause. P.N.F.

N71-34031# National Transportation Safety Board, Washington, D.C.
AIRCRAFT ACCIDENT REPORT. COMPANIA ECUATORIANA DE AVIACION DOUGLAS C-54D, REPUBLIC OF ECUADOR, HC-AON MIAMI INTERNATIONAL AIRPORT, MIAMI, FLORIDA, 14 APRIL 1970
16 Dec. 1970 28 p
(PB-199330; NTSB-AAR-71-2) Avail: NTIS CSCL 01B

A Douglas C-54D, HC-AON, of Ecuadorian registration, crashed at Miami International Airport, Miami, Florida, at approximately 0724 e.s.t., April 14, 1970. The aircraft was being operated as an international cargo flight by Compania Ecuatoriana de Aviacion. The accident occurred during the initial climb, following an instrument takeoff on Runway 27 right at Miami International Airport. The flight was en route from Miami to Panama City, Panama; the first leg of a flight which was to terminate at Quito, Ecuador. The two pilots, the only occupants of the aircraft, were killed, and the aircraft was demolished by impact and postimpact ground fire. The board determines that the probable cause of this accident was improper monitoring of the flight instruments during a takeoff in instrument meteorological conditions. Additional pertinent factors were the use of improper procedures after takeoff and the reduced visibility due to fog. Author (GRA)

N71-34032# Tri-State Transportation Commission, New York.
METROPOLITAN AIRCRAFT NOISE ABATEMENT POLICY STUDY, JOHN F. KENNEDY INTERNATIONAL AIRPORT, NEW YORK, NEW YORK
1970 126 p refs Sponsored in part by the Dept. of Housing and Urban Develop., Washington, D. C.
(PB-199723) Avail: NTIS CSCL 01B

Alternative measures, and combinations of measures. To provide relief from aircraft noise in affected communities around John F. Kennedy International Airport are presented. Recommendations for reducing aircraft-noise problems are discussed. Author (GRA)

N71-34033# Tri-State Transportation Commission, New York.
METROPOLITAN AIRCRAFT NOISE ABATEMENT POLICY STUDY, JOHN F. KENNEDY INTERNATIONAL AIRPORT, NEW YORK, NEW YORK. TECHNICAL SUPPLEMENT: CERTAIN LEGAL ASPECTS OF REQUIRED SOUNDPROOFING IN HIGH NOISE AREAS
Feb. 1971 133 p refs Prepared by Cleary, Gottlieb, Steen, and Hamilton, New York
(PB-199725; Rept-9613) Avail: NTIS CSCL 01B

With respect to airplane noise in the high noise areas next to John F. Kennedy International Airport, the report considers certain legal aspects of state and local compulsory soundproofing proposals with respect to new and existing structures. The study is made primarily in light of Federal and New York state constitutional provisions and certain state and local legislation. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic, and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-34034*# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
A STUDY OF GAS SOLUBILITIES AND TRANSPORT PROPERTIES IN FUEL CELL ELECTROLYTES Semiannual Report, 1 Sep. 1970 - 28 Feb. 1971
R. D. Walker, Jr. 17 Jun. 1971 106 p refs
(Grant NGL-10-005-022)
(NASA-CR-121628; SAR-11) Avail: NTIS CSCL 10C

Measurements using a differential manometer were made of the vapor pressure of the system KOH-K2CO3-H2O at 25, 40, 60, and 80 C over considerable concentration ranges of both KOH and K2CO3. It was found that the vapor pressure can be correlated for each temperature as a function dependent only on the ionic concentration. Partial molal volume of gases in electrolyte solutions were measured for a wide variety of gases and ions. The dilatometric method was found to be an accurate, reliable and consistent method, provided care was taken in temperature and pressure controls. The results are comparable with literature values for gases in pure water, and were discussed in light of the perturbation theory. Work on the measurement of the diffusion coefficients of hydrogen in lithium hydroxide solution was continued. Measurements were made for the temperatures 25, 40, 60, and 80 C over the complete concentration range. The results are relatively well predicted by the modified Eyring theory and the kinetic theory. Author

N71-34035*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation and Engineering Lab. Dept.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: ACCEPTANCE TESTS OF GULTON INDUSTRIES 100.0 AMPERE-HOUR NICKEL-CADMIUM CELLS
R. E. Thomas 20 Jul. 1971 20 p refs
(NASA Order W-12397)
(NASA-CR-121618; QE/C-71-283) Avail: NTIS CSCL 10C

The results are presented of acceptance tests to insure that all cells put into the life cycle program for secondary spacecraft cells are of high quality. Twenty-three cells were tested and the following results were observed: (1) The capacity of the cells ranged from 48.3 to 125.0 ampere-hours, and ten cells delivered less than rated capacity on one or more of the three capacity checks. (2) Five cells failed to recover to 1.200 volts as established by the procedure for the cell short tests. (3) Electrolyte leakage was not observed for any of the cells. On the basis of these findings it was recommended that the cells not be placed on life cycling. D.L.G.

N71-34036*# Hughes Aircraft Co., El Segundo, Calif.
SOLAR CELL RADIATION DAMAGE EXPERIMENT Quarterly Report, 28 Mar. - 27 Jun. 1971
27 Jun. 1971 33 p
(Contract NAS5-11677)
(NASA-CR-121614; QR-8) Avail: NTIS CSCL 10A

High accuracy data permitting a technical evaluation of the effects of the space radiation environments on solar cells is discussed. The flight experiment consists of a small solar panel mounted externally on the environmental measurements experiment (EME) package, which will interface with the spacecraft. The solar panel has a total of 80 solar cells, representing 16 solar cell configurations. Thirteen solar cell configurations will be mounted to the rigid panel portion of the solar panel and three configurations will be mounted to the flexible panel. In addition, the experiment has two signal processor units required for data sampling and telemetry. The solar cell experiment will be activated at programmed intervals to obtain voltage-current data for each individual solar cell and to obtain temperature and calibration data. In addition to the design and fabrication of the flight experiment, a ground test program will be run. Data resulting from this program will be used as an aid in selecting the solar cell configurations for the flight experiment. The program includes evaluation of the effects on solar cells and solar cell assemblies under an environment which simulates both synchronous electrons and low energy protons. Author

N71-34037*# Clevite Corp., Cleveland, Ohio. Electronic Research Dept.
CdS SOLAR CELL DEVELOPMENT Final Report
H. E. Nastelin, J. M. Smith, III, and A. L. Gombach 16 Jun. 1971 137 p refs
(Contract NAS3-13467)
(NASA-CR-72969) Avail: NTIS CSCL 10A

Studies were conducted on the effects of variations in manufacturing processes on cell performance, with particular attention to temperature during evaporation and to temperature and time exposure in air after barriering. In general, the existence of broad optimums was verified. A variety of cover plastics were evaluated and a method of very rapid heat bonding on FEP Teflon was developed. Studies were conducted on interlayer surfaces using X-ray diffraction and SEM techniques. Performance of cells was definitely correlated to surface characteristics of the silver Pyre ML paint and the further effect of this surface on alloying of the zinc layer with the silver was investigated. Variations of the grid structure were evaluated. Stability testing was continued for the 5th year under conditions of dry shelf, vacuum, and moisture storage. Author

N71-34038*# Tyco Labs., Inc., Waltham, Mass.
DEVELOPMENT OF UNIFORM AND PREDICTABLE BATTERY MATERIALS FOR NICKEL-CADMIUM AEROSPACE CELLS Interim Annual Report, 8 Sep. 1969 - 7 Sep. 1970
7 Sep. 1970 77 p refs
(Contract NAS5-11561)
(NASA-CR-121746) Avail: NTIS CSCL 10C

Three basic processes of the impregnation of nickel plaque to form nickel cadmium battery plates were examined: (1) chemical conversion of the nitrates to the hydroxides; (2) the method first described by Fleischer; and (3) electrochemical conversion at 25 C. The aim was to define the procedures and preparative conditions that would give rise to the most uniform components in a reproducible manner. The variables considered were solution concentration for chemical conversion, current density for the Fleischer method, and the loading for both methods. These variables were chosen for more detailed study from a previous preliminary examination of impregnation methods. The plates were examined in terms of uniformity and reproducibility of weight gain, capacity, and utilization. The determination of utilization demanded chemical analysis of the active materials. Since analytical procedures are not well defined in the literature, significant effort was devoted to the development of reproducible and accurate analytical methods. It was concluded from the experimental data collected on the impregnation methods that more uniform and reproducible plates were prepared by the chemical conversion process. For the positive plates, the less concentrated impregnation solution are to be preferred. No distinction could be drawn for the negatives. Plates prepared by the electrochemical process were noticeably lower in reproducibility and uniformity. Author

N71-34039*# Minnesota Mining and Mfg. Co., St. Paul, Minn. Space and Defense Products Dept.
SOLAR CELL CONTACT DEVELOPMENT Final Report, 28 Jun. 1968 - 1 Mar. 1970
R. L. Jacobson and G. S. Anderson Mar. 1970 117 p refs
(Contract NAS5-11595)

(NASA-CR-121725) Avail: NTIS CSCL 10A

The results are presented of work performed during the period 28 June 1968 through 28 June 1969. Degradation was characterized by examining a number of degraded cells. The results of this study strongly suggested that contacts degrade by diffusion of corrosive species through the Ag overlayer with the eventual corrosion of the underlying layer of Ti. The general porosity of thin Ag films was demonstrated by exposing Ti/Ag contacts to various corrosive environments. Sputtering was applied to the deposition of Ti/Ag and Ti-Pt/Ag contacts onto Si wafers and the properties of these contacts were evaluated. Finally, Ti/Ag and Ti-Pt/Ag contacts were sputter deposited onto Si solar cell blanks. Modifications in cell blank cleaning procedures resulted in the successful preparation of 40 cells for evaluation by NASA-Goddard. Author

N71-34040*# Eagle-Picher Co., Joplin, Mo. Couples Dept.
STUDY OF PROCESS VARIABLES ASSOCIATED WITH MANUFACTURING HERMETICALLY SEALED NICKEL-CADMIUM CELLS Quarterly Report, 24 Aug. - 24 Nov. 1970
Lee Miller, Donald J. Doan, and Earl S. Carr Jul. 1971 106 p refs
(Contract NAS5-21159)
(NASA-CR-121877; QR-3) Avail: NTIS CSCL 10C

Process variables associated with electrochemical cleaning or formation operation which follows the completion of the impregnation/polarization process of nickel cadmium cells are investigated. Parameters selected for study are formation time, specific gravity of the KOH solution, and overcharge amount. The necessary equipment was procured and setup for the measurement of the electrical capacity of a single positive or negative plate. The test procedure and apparatus are described. Preliminary quality assurance specification for sintered nickel plaques, separator materials, and ceramic-to-metal seal cover assemblies were prepared. A copy of each is included with a brief discussion. Author

N71-34041*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THERMAL CYCLING EFFECTS ON SOLAR CELL INTERCONNECTION TABS ON AN OAO-B SAMPLE MODULE
Clara M. Vermillion Jul. 1971 63 p refs
(NASA-TM-X-65679; X761-71-315) Avail: NTIS CSCL 10A

Thermal cycling tests (in air) were performed on a sample OAO module incorporating intentionally bent solar cell interconnection tabs. Inspection of the tabs at various intervals during 300 cycles of testing between +104 C and -60 C disclosed a high defect and failure development rate (approximately 25%) both in the bent tabs and in normal tabs. The main failure mode was cracking, leading to breakage, of the tabs. In most cases (approximately 60%) this occurred at the bend adjacent to the solder joint. The secondary location (approximately 20%) was at the point of severe bends and crimps. Since similar tests of a complete flight paddle but under vacuum conditions showed a much lower failure rate and also showed the major failure mode to be solder joint failure, it was concluded that the module test results, either because of differences in workmanship and materials or because the tests were performed in air, were not applicable to prediction of flight paddle performance. Author

N71-34042*# Pennsylvania Univ., Philadelphia. Inst. for Direct Energy Conversion.
RESEARCH FOR THE IMPROVEMENT OF SILICON SOLAR CELL EFFICIENCY Status Report, 1 Jul. - 31 Dec. 1970
M. Wolf Jan. 1971 69 p refs
(Grant NGL-39-010-001)
(NASA-CR-121751; SR-17) Avail: NTIS CSCL 10A

The interrelationships between material and dimensional parameters in their influence on collection efficiency from both the base region and the diffused region were investigated. Some of the essential results were: (1) It is theoretically possible to collect over 99% of the minority carriers generated by photon absorption, even in thin solar cells. (2) A wide range of material and dimensional parameter combinations permits approaching the ideal case. (3) Until diffusion length in the diffused region can be better controlled than at present, improvement has to be accomplished through thickness reduction. (4) Reduction of surface recombination velocity will be a necessity. (5) Base region diffusion lengths, as achievable with present technologies, are sufficient from the collection efficiency viewpoint. (6) In the base region, the detrimental effect of the back contact can be neutralized by a drift field in front of the back contact. (7) Longer minority carrier lifetimes will be wanted. Author

N71-34043*# Hamilton Standard, Windsor Locks, Conn.
FEASIBILITY STUDY OF A HUMIDITY CONTROL AND OXYGEN SUPPLY SYSTEM UTILIZING A WATER VAPOR ELECTROLYSIS UNIT
J. C. Huddleston and J. R. Aylward Apr. 1971 121 p refs
(Contract NAS9-10773)
(NASA-CR-115070; SVHSER-5901) Avail: NTIS CSCL 10A

The design and test effort involved in the development of an improved water vapor electrolysis cell are presented for generating and controlling a spacecraft's oxygen and for supplementing a spacecraft's humidity control system. Author

N71-34044*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLAR CELL MATRIX Patent Application
Robert K. Yasui, inventor (to NASA) Filed 17 Feb. 1971 19 p
(Contract NAS7-100)
(NASA-Case-NPO-11190; US-Patent-Appl-SN-115944) Avail: NTIS CSCL 10A

A solar cell matrix formed of a plurality of electrically coupled and individually encapsulated solar cells is described. A particular feature of the invention resides in the use of a substantially rigid structure individually encasing each of the solar cells whereby the solar cell is protected against accidental impact and a deposition of contaminants. NASA

N71-34045*# Globe-Union, Inc., El Monte, Calif.
RESEARCH, DEVELOPMENT AND FABRICATION OF LITHIUM SOLAR CELLS Quarterly Report to Jan. 1971
Peter A. Iles Jan. 1971 23 p ref Prepared for JPL
(Contracts NAS7-100; JPL-952548)
(NASA-CR-121677) Avail: NTIS CSCL 10A

Continuing research is reported on lithium solar cell fabrication techniques with emphasis on lithium diffusion temperatures below 400 C, and with single cycle diffusion rather than redistribution cycles. Measurements of lithium concentration at the back surface showed that the surface concentration changes with time, consisting of a buildup to a maximum value with gradual decrease at longer diffusion times. Using the estimated surface concentration values, theoretical lithium profiles were calculated. The calculated concentration near the p-n junction was higher than those measured by the capacitance-voltage technique. The calculated concentration gradients were one-seventh of those measured by capacitance voltage-methods. Estimates of surface concentration obtained by extrapolating from capacitance-voltage measured values of concentration and gradient near the p-n junction, showed a decrease in surface concentration for longer diffusion times. It was concluded that the volt-ampere characteristics were well controlled, with good cell output, but for longer diffusion times the lithium concentration gradient could have wider spread. D.L.G.

N71-34046*# TRW Capacitor Div., Ogallala, Nebr.
DESIGN AND APPLICATION OF POLYCARBONATE CAPACITORS IN AEROSPACE ac POWER SYSTEMS
J. F. Goode, A. C. Elles, and R. R. Bailey Washington NASA Aug. 1971 98 p ref

(Contract NAS3-11834)
(NASA-CR-1897) Avail: NTIS CSCL 10C

Aerospace quality, hermetically sealed, wound, ac polycarbonate capacitors of metallized and film foil construction were designed and subjected to a 5000 hour, 400 Hz life test. Temperature and voltage conditions for the life test were selected to force failures. Analysis of failed capacitors established failure causes. Recommendations are made for improvements in the design and processing of polycarbonate capacitors for ac application in aerospace power systems. Author

N71-34047# Argonne National Lab., Ill. Chemistry Engineering Div.
LITHIUM/SELENIUM SECONDARY CELLS FOR COMPONENTS IN ELECTRIC VEHICULAR PROPULSION GENERATING SYSTEMS Interim Technical Summary Report, 23 Nov. 1969 - 22 May 1970
E. J. Cairns, E. C. Gay, V. M. Kolba, M. L. Kyle, A. D. Tevebaugh et al Nov. 1970 86 p refs Sponsored in part by Army Mobility Equipment Res. and Develop. Center
(Contract W-31-109-eng-38)
(ANL-7745; Rept-2) Avail: NTIS

The battery program has as its ultimate goal the development of multikilowatt lithium/selenium secondary batteries for electrically driven Army vehicles. The shorter-term objective is to develop paste-electrolyte cells having lifetimes of 1000 to 2000 hours and 1000 to 2000 charge-discharge cycles. Seventeen cells were tested showing an ampere-hour efficiency of 0.92 and having the capability of delivering 52% of the theoretical capacity at the 1-hour discharge rate. Cycle lives of 10 to 13 cycles were obtained during operating times of 120 hours. The life-limiting factor was the transference of selenium to the lithium electrode. Observed resistivity ratios (resistivity of paste/resistivity of salt) were typically greater (by factors of 1.1 to 1.4) than the theoretical values calculated from the Maxwell equation. The Maxwell values are assumed to represent the minimum attainable resistivity ratio. Author (NSA)

N71-34048*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATION EXPRESSION FOR THE PERFORMANCE OF AN ETCHED-RHENIUM EMITTER, NIOBIUM COLLECTOR, CESIATED THERMIONIC CONVERTER
Roland Breitwieser Washington Sep. 1971 5 p refs
(NASA-TM-X-2380; E-6405) Avail: NTIS CSCL 10A

An equation is presented that correlates current, voltage, emitter temperature, and collector temperature of a cesiated thermionic converter using an etched-rhenium emitter and a niobium collector. Author

N71-34049*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER-ACQUIRED PERFORMANCE DATA FROM A CHEMICALLY VAPOR-DEPOSITED-TUNGSTEN, NIOBIUM PLANAR DIODE
Arthur L. Smith Washington Sep. 1971 21 p refs
(NASA-TM-X-2373; E-6406) Avail: NTIS CSCL 10A

Performance data from a chemically vapor-deposited-tungsten, niobium thermionic converter are presented. The planar converter has a guard-ringed collector and a fixed spacing of 10 mils. The data were acquired using a computer and are available on microfiche as individual or composite parametric J,V curves. The parameters are the temperatures of the emitter T sub E, collector T sub C, and cesium reservoir T sub R. The composite plots have constant T sub E and varying T sub C or T sub R, or both. The envelope and composite plots having constant T sub E are presented. The diode was tested at increments between 1500 and 2000 K for the emitter, 748 and 1149 K for the collector, and 545 and 652 K for the reservoir. In all, 479 individual current, voltage curves were obtained. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-34050*# Stanford Univ., Calif. Cardiology Div.
ULTRASOUND IN THE EARLY DETECTION AND STUDY OF POST-TRANSPLANTATION CARDIAC REJECTION
Richard L. Popp, John S. Schroeder, Edward B. Stinson, Norman E. Shumway, and Donald C. Harrison [1970] 13 p refs
(Grant NGL-05-020-305)
(NASA-Cr-121642) Avail: NTIS CSCL 06P

The application of ultrasonic techniques to the early detection of heart transplant rejection is discussed. Physiological changes in the structure of the heart may be detected by ultrasonic measurements and action taken to reduce the risk of rejection. P.N.F.

N71-34051*# Stanford Univ., Calif. Cardiology Div.
CIRCULATORY RESPONSES TO HYPOXIA IN EXPERIMENTAL MYOCARDIAL INFARCTION
Marianne Schroll, Sherilyn C. Robison, and Donald C. Harrison [1971] 26 p refs
(Grant NGL-05-020-305; HE-09058; HE-5709; HE-5866)
(NASA-CR-121665) Avail: NTIS CSCL 06P

Three levels of decreased arterial oxygen saturation elicited a graded circulatory response in dogs, manifested by stepwise increases in cardiac output, left ventricular dp/dt, and stroke volume. Responses to similar hypoxia challenges following experimental myocardial infarction were qualitatively similar but quantitatively less. Although the circulatory compensation for hypoxia was less effective following myocardial infarction, no further deterioration of the hemodynamics was noted. Author

N71-34052*# Stanford Univ., Calif. Cardiology Div.
EVALUATION OF THE CARDIOVASCULAR SYSTEM DURING VARIOUS CIRCULATORY STRESSES Progress Report, 1 Jun. 1970 - 31 May 1971
Harrison Donald C. 31 May 1971 21 p refs
(Grant NGL-05-020-305)
(NASA-CR-121666) Avail: NTIS CSCL 06P

The research in developing hardware and techniques for studying man's circulatory performance in the space environment is reported, and research proposals for the next year are presented. The areas of accomplishments reported include: (1) testing a noninvasive method for measuring venous pressure, (2) computer graphic techniques for studying the function of the left ventricle, (3) the validity of new intravascular pressure sensors, and (4) ultrasound techniques for determining ventricular volume and cardiac output. The proposals include work in developing improvements in noninvasive techniques for measuring cardiovascular performance, and studies to understand more precisely the way in which the circulatory system responds to stresses. Abstracts of papers published during the reporting period are presented. F.O.S.

N71-34063*# Avco-Everett Research Lab., Everett, Mass.
THE FLUID MECHANICS OF THROMBUS FORMATION Final Technical Report
Jul. 1971 69 p refs
(Contract NASw-1894)
(NASA-CR-121668) Avail: NTIS CSCL 06P

Experimental data are presented for the growth of thrombi (blood clots) in a stagnation point flow of fresh blood. Thrombus shape, size, and structure are shown to depend on local flow conditions. The evolution of a thrombus is described in terms of a physical model that includes platelet diffusion, a platelet aggregation mechanism, and diffusion and convection of the

chemical species responsible for aggregation. Diffusion-controlled and convection-controlled regimes are defined by flow parameters and thrombus location, and the characteristic growth pattern in each regime is explained. Quantitative comparisons with an approximate theoretical model are presented, and a more general model is formulated. Author

N71-34064*# Food and Drug Administration, Cincinnati, Ohio. Div. of Microbiology.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Oct. 1970 - 31 Dec. 1970
A. L. Reyes and J. E. Campbell Mar. 1971 12 p
(NASA Order R-36-015-001)
(NASA-CR-121727; QPR-23) Avail: NTIS CSCL 06M

A continuing investigation in identifying the thermal inactivation curve of B. subtilis var. niger spores is reported. Several experiments were conducted to determine the nature of the curve under 0.25, 2.6,10,100, and 500 micrograms of water per ml of headspace. The conventional plate count method was used in assaying spore survivors ranging from 1 million to less than 10 spores per cup. The data obtained are given along with discussions as to their significance. In addition, the results of tests conducted on the hardware and equipment to be used for the evaluation of a terminal sterilization process for unmanned landers are presented. D.L.G.

N71-34056*# Miami Univ., Coral Gables, Fla.
CUEBS NEWS, VOLUME 7, NO. 3
Feb. 1971 19 p refs
(Grant NGR-10-007-008)
(NASA-CR-121726) Avail: NTIS CSCL 06C

Articles concerning undergraduate education in the biological sciences are presented. Individual titles include: (1) The Investigative Laboratory in an Introductory Biology Course for Nonscience Majors at Marquette University; (2) An Introductory Investigative Laboratory at a Two-Year Community College; (3) Biology for Physicists: Two views on Working papers No. 2; (4) The Three i's - Interdisciplinary, Investigative, and Independent Study; and (5) Reflections on a Visit to the Minicourse Project at Purdue. In addition, a continuation of a previously published article 'Biology in the Next Two Decades' is presented. The continuation deals with new generalizations concerning life and its origins. D.L.G.

N71-34066*# Boeing Co., Seattle, Wash. Aerospace Group.
RELEASE OF MICROORGANISMS FROM SOLID MATERIALS Final Report
E. A. Gustan and R. L. Olson Jul. 1971 86 p
(Contract NAS7-100)
(NASA-CR-121707) Avail: NTIS CSCL 06M

Information on the release of microorganisms by hard impact and the effect of aeolian erosion on the release of microorganisms are discussed. The efficiency of grinding, as compared to dissolution, for recovery of microorganisms from solids was determined. An adjustment constant of 20 was derived from the data that can be used to equate bacterial spore counts obtained by grinding with those obtained by dissolution. The percentage of microorganisms released due to hard impact of Eccobond onto sand was determined. Eccobond was impacted onto sand at velocities of 168, 457, 945 and 1554 m/sec. The results showed that less than 1 percent of the available organisms was released by impact. The percentage of bacterial spores released from methyl methacrylate and Eccobond by aeolian erosion was determined. Sand, accelerated by air or carbon dioxide, was used to erode 0.25 grams of material from one gram discs. The results showed that less than 1 percent of the available organisms was released by the erosion process. Author

N71-34067*# Becton, Dickinson and Co., Raleigh, N.C. Microbiological Science Dept.
DEVELOPMENT OF PARAMETRIC DATA FOR THE ESTABLISHMENT OF AN ETHYLENE OXIDE CYCLE FOR THE DECONTAMINATION OF SPACECRAFT Final Report
D. J. Daley and J. L. Sliger Jul. 1971 170 p refs Prepared in cooperation with JPL
(Contract NAS7-100; JPL-952169)
(NASA-CR-121764) Avail: NTIS CSCL 06A

A decontamination chamber with the capability of maintaining set parameters of temperature, relative humidity, pressure and gas concentration was designed and fabricated. After establishing proper operation of the chamber, a sufficient number of cycles were conducted to gain some insight into the operation of the chamber and the effects of varying parameters and cycle phases on the efficiency of sterilization of spacecraft-type materials. The test pieces included glass, plastic, and stainless steel strips, capillary tubing, and open and Morton-capped test tubes, which were inoculated in all but one test series with spores of Bacillus subtilis var. niger. Morton-capped and capillary tubes were the most difficult test pieces to decontaminate. Stainless steel strips were the easiest test pieces to decontaminate. With respect to the individual parameters investigated, relative humidity appeared to have the most pronounced effect on sterilizing efficiency. An improved spore kill was observed when relative humidity was increased from 30% to 50% in the 50 C cycles. Effects of gas concentration, time and temperature might have been manifest with further testing. Author

N71-34068*# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
DETERMINATION OF THE RADIONUCLIDE CONTENT OF FECES AND URINE FROM ASTRONAUTS ENGAGED IN SPACE FLIGHT Quarterly Research Report, 1 Jul. - 5 Oct. 1969
R. L. Brodzinski and L. A. Rancitelli 15 Oct. 1969 25 p refs
(Contract AT(45-1)-1830; Proj. Apollo)
(NASA-CR-121861; BNWL-1183-2) Avail: NTIS CSCL 06R

Research efforts were directed primarily toward activation analysis of the astronauts' excreta to initiate studies involving the effects of the space environment on the mass balance of various elements by the body and delineate the future research in this area. The concentrations of 17 elements in the astronaut fecal samples from Apollos 7 and 9 and the calcium concentrations from Apollos 8 and 10 are reported. The search for possible Pm-147 contamination in the space capsule environment continued with an investigation of some filter media from the Apollo 10 air purification canister. No Pm-147 contamination was observed in the spacecraft. A search for the presence of gaseous decay products of lunar uranium and thorium in the lunar atmosphere which might have become imbedded in the spacecraft skin during the lunar orbiting of Apollo 10 was attempted. The concentrations of the thorium and uranium daughter products in the sampled spacecraft skin were below detectable limits. Author

N71-34069*# Battelle Memorial Inst., Richland, Wash. Pacific Northwest Labs.
DETERMINATION OF THE RADIONUCLIDE CONTENT OF FECES AND URINE FROM ASTRONAUTS ENGAGED IN SPACE FLIGHT Quarterly Research Report, 8 Apr. - 30 Jun. 1969
R. L. Brodzinski, H. E. Palmer, and L. A. Rancitelli 15 Jul. 1969 49 p refs
(Contract AT(45-1)-1830; Proj. Apollo)
(NASA-CR-121860; BNWL-1183-1) Avail: NTIS CSCL 06R

The results are presented of a study to evaluate radiation activation during the course of Apollo 7, 8, 9, and 10 missions by counting the radionuclides excreted in the feces and urine of the astronauts. Observed radioisotopes were Be-7, Na-22, Na-24, K-40, Cr-51, Fe-59, Co-60, and Cs-137. The Cr-51, Fe-59, and Co-60 were from preflight injection; the K-40 and Cs-137 are naturally occurring or normally present; the Be-7 and

Na-22 were both of normally occurring and cosmogenic origins; the Na-24 was cosmogenic. An evaluation of the data indicates that: (1) the Apollo 7 astronauts were exposed to protons with an average effective energy of 38 to 40 MeV, and that the radiation dose was 480 + or - 310 mrads at the 65% confidence level; (2) the Apollo 8 astronauts were exposed to protons of less than 38 MeV; (3) the radiation dose received by the Apollo 9 astronauts was less than 315 mrads; and (4) the radiation dose received by the Apollo 10 astronauts was 870 + or - 550 mrads. Other studies are reported which include: neutron activation analysis of feces and urine of astronauts, induced radioisotopes in spacecraft, promethium 147 in the space capsule environment, and calibration of the NASA whole-body counter. D.L.G.

N71-34060*# Technology, Inc., San Antonio, Tex. Life Sciences Div.

RESEARCH ON PHYSICAL AND PHYSIOLOGICAL ASPECTS OF VISUAL OPTICS IN SPACE FLIGHT Final Report, 28 May 1970 - 28 May 1971

Brian Ward, Stanley Collyer, Clarke A. Burnham, Patrick W. Wilson, Stanley A. Dunbar et al 30 Jul. 1971 96 p refs (Contract NAS9-11085)

(NASA-CR-115120) Avail: NTIS CSCL 06P

Individual research projects reported include: (1) retinal temperature calculations for the specification of adequate eye protection at the lunar surface; (2) a survey of hazardous visual perceptions in space flight; (3) measurement of the optical properties of new and used visual transparencies; (4) analysis of visual problems in space flight; and (5) analysis of problems in the general areas of vision, audition, and neurophysiology. D.L.G.

N71-34061*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

PROCESS FOR CONTROL OF CELL DIVISION Patent Application

Clarence D. Cone, Jr., inventor (to NASA) Filed 17 Mar. 1971 20 p

(NASA-Case-LAR-10773-1; US-Patent-Appl-SN-125235) Avail: NTIS CSCL 06M

A method of controlling mitosis of biological cells by inducing a change in the intracellular ionic hierarchy accompanying the cellar electrical transmembrane potential difference (E sub m) of the cells, is described. The ionic hierarchy may be varied by imposing changes on the relative concentrations of Na(+), K(+), and Cl(-), or by directly imposed changes of the physical E sub m level across the cell surface. NASA

N71-34062# Joint Publications Research Service, Washington, D.C.

STOMATOLOGIC CARE IN SPACE FLIGHTS

G. M. Ivashchenko et al 24 Aug. 1971 13 p refs Transl. into ENGLISH from Stomatologiya (USSR), no. 4, 1971 p 89-93 (JPRS-53894) Avail: NTIS

An analysis was made of the position of stomatologic illnesses within the complex of pathologic changes in the human body during long space flights. Reports on stomatologic illnesses of humans in unusual conditions are summarized and the principal tasks faced by stomatologists in providing care during space flights and the simulating ground experiments are outlined. J.G.M.

N71-34063# Joint Publications Research Service, Washington, D.C.

SHIFTS IN THE BLOOD OF POLAR WORKERS IN THE ANTARCTIC

B. B. Ventsenostsev 23 Aug. 1971 8 p refs Transl. into ENGLISH from Klin. Med. (Moscow), no. 6, 1971 p 40-44 (JPRS-53894) Avail: NTIS

Human adaptive reactions and possible explanations for the distinctions in the clinical course of some diseases were investigated by studying the changes in the peripheral blood of individuals during acclimatization to the extreme conditions of the Antarctic. The influence of geographic and cosmic factors on hematopoiesis was also considered. Results of the few available studies dealing with blood tests on polar workers in coastal Antarctic stations are reviewed and detailed statistical data are provided on blood shifts among members of the 11th Soviet Antarctic expedition to the Molodezhnaya Station. J.G.M.

N71-34064# Cincinnati Univ., Ohio.

NOISE DISTURBANCE AND SLEEP. THE RELATIONSHIP OF NOISE DISTURBED SLEEP TO POST-SLEEP BEHAVIOR: AN EXPLORATION STUDY Final Report

Milton Kramer, Thomas Roth, John Trindar, and Alexander Cohen Jan. 1971 176 p refs Prepared in cooperation with PHS, Cincinnati, Ohio

(Contracts DOT-FA-WAI-164; CPE-69-132)

(FAA-NO-70-16) Avail: NTIS

The effects of noise on sleep and post-sleep behavior in two 25, 50, and 70 year-old males is discussed. The subjects were run for 15 consecutive nights, the first five and the fifteenth serving as controls. Following each night's sleep, subjects completed a series of performance and psychological tests. Threshold sound levels for sleep disturbance were obtained for an impulse and a continuous test noise and discussed in terms of type of sleep disturbance, stage of sleep, time of night, adaptation, and age of subjects. The sleep profile results indicated that the pattern of noise-induced sleep disruption was related to age. The 25-year olds showed an increase in stage 1 and movement time. The 70-year olds showed an increase in time awake and a decrease in time spent in stage 3-4. The 50-year old subjects were intermediate with respect to each measure. The daytime performance data revealed no effects of noise-induced sleep disruption on pursuit rotor and reaction time tasks but some decrements were found in time estimation, arithmetic, and memory task measures. In addition, verbal sample scores demonstrated an increase in cognitive impairment and a decrease in human relations. Author

N71-34065# Institute for Perception RVO-TNO, Soesterberg (Netherlands).

OBJECT RECOGNITION IN AIDED AND UNAIDED NIGHT VISION

A. van Meeteren and F. W. Zonneveld 1971 26 p refs (IZF-1971-7; TDCK-57805) Avail: NTIS

The recognition of 20 military objects with and without a three-stage image intensifier was studied as a function of luminance. The objects, photographed in the center of a landscape mock-up, were presented to 20 subjects by slide projection. They were recognized with the image intensifier at a 600 times lower luminance than with the naked eye. An information score is defined such that along with object identifications of individual objects it also evaluates recognitions of object classes and thus provides a good performance measure. A clear-cut relation was found between the information score and the percentage of correct object identifications. The supposedly realistic collection of 20 test objects did not lead to invariant confusion classes and consequently did not allow a precise definition of class-recognition. Author

N71-34066# Oak Ridge National Lab., Tenn.

NEUTRON DEPTH DOSE DISTRIBUTIONS IN HETEROGENEOUS PHANTOMS

John W. Poston (Ph.D. Thesis - Georgia Inst. of Tech.) Apr. 1971 127 p refs (Contract W-7405-eng-26)

(ORNL-TM-3329) Avail: NTIS

The design and operational characteristics of extrapolation ionization chambers intended to measure analogous distributions due to fast neutrons are described. Measured distributions due to fission spectrum and 14-MeV neutrons are presented and discussed. Results from measurements with fission spectrum neutrons indicate that the high voltage electrodes attached to

the front of the detectors were too thick to allow the measurement of the changes in dose distributions very near the interface. However, distributions due to 14-MeV neutrons indicate a reduction in the predicted homogeneous depth dose distribution due to the presence of bone. The reduction is about 20% at a distance in bone of about 2 cm. In tissue at the rear of bone, a buildup or increase in the dose deposited was demonstrated which is about 50% more than the interface value at a depth in tissue of 0.8 to 1.0 cm. These results are discussed and compared with available theoretical descriptions. Also included is a discussion of the problems associated with the use of these detectors, the sources of error in the experiment, and a set of recommendations for improvement and further study in this area. Author (NSA)

N71-34067# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
AFFECT ADJECTIVE CHECK LIST ASSESSMENT OF MOOD VARIATIONS IN AIR TRAFFIC CONTROLLERS
Roger C. Smith, C. E. Melton, and Jess M. Mc Kenzie Apr. 1971 9 p refs
(FAA-AM-71-21) Avail: NTIS

Three groups of subjects completed Composite Mood Adjective Check Lists (CMACL) before and after selected shifts at two air traffic control (ATC) facilities as part of a multi-discipline study of stress in ATC work. At one facility, a high traffic density tower (HDT), 22 air traffic control specialists (ATCS) were sampled before and after five evening (1500 to 2300) shifts and five night (0000 to 0800) shifts. At the second facility, a moderate traffic density tower (MDT), 16 ATCSs were assessed on three day (0800 to 1600) and three night (0000 to 0800) shifts. In addition, four non-ATC individuals involved in monitoring the MDT ATCSs for other aspects of the general stress study served as controls. It was found that all subjects, both ATCSs and controls, showed a considerable increase in feelings associated with fatigue and tiredness as a function of working an eight-hour shift. These effects were generally more pronounced for night shifts. There were no differences between subject groups on the variables predicted to be most sensitive to variations in stress. Findings are discussed in terms of expected work effects and the lack of significant stress variations. Author

N71-34068# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
THE EFFECTS OF SIMULATED SONIC BOOMS ON TRACKING PERFORMANCE AND AUTONOMIC RESPONSE
Richard I. Thackray, R. Mark Touchstone, and Karen N. Jones Jun. 1971 16 p refs
(FAA-AM-71-29) Avail: NTIS

Subjects were exposed to four simulated indoor sonic booms over an approximate thirty-minute period. The overpressure levels were 1.0, 2.0 and 4.0 psf (as measured outdoor) with durations of 295 milliseconds. Subjects performed a two-dimensional compensatory tracking task during the exposure period and continuous recordings were obtained of heart rate and skin conductance. No evidence of performance impairment was found for any of the overpressure levels. Rather, performance improved significantly following boom stimulation along with heart-rate deceleration and skin conductance increase. The obtained pattern suggests that the simulated booms may have elicited more of an orienting or alerting response than a startle reflex. The results are discussed in terms of the possible importance of rise time as a determinant of the physiological and performance effects which may be produced by sonic booms. Author

N71-34069# Army Edgewood Arsenal, Md.
RESPONSES OF SINGLE CELLS WITHIN THE CAT MEDULLA DURING PROLONGED CONSTANT ANGULAR ACCELERATION Technical Report, Feb. 1968 - Jan. 1970
George H. Crampton and Kenneth J. Gall Apr. 1971 33 p refs
(AD-724628; EA-TR-4505) Avail: NTIS CSCL 06/19

Single cell discharges from within the vestibular nuclei were recorded during constant angular accelerations of up to 5-min duration and during sinusoidal angular acceleration. The forms of discharge patterns are described and emphasis is placed on analyses of adaptation to long term constant stimuli. The great majority of the units will show a discharge increase and then a decline during the first 45 sec of acceleration. Results from longer accelerations, however, lead to the conclusion that a simple model based on a slightly underdamped cupular mechanism does not conform to the responses and neither does an adaptation explanation. It is speculated that a substantial processing of the sensory input takes place at the level of the second-order neuron and what is often seen in these recordings are functions more closely correlated with various response requirements than with one-to-one events at the sense organ. Author (GRA)

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-34070*# Southwest Research Inst., San Antonio, Tex.
SOUTHWEST RESEARCH INSTITUTE ASSISTANCE TO NASA IN BIOMEDICAL AREAS OF THE TECHNOLOGY UTILIZATION PROGRAM Semiannual Report, 25 Aug. 1970 - 28 Feb. 1971
David F. Culclasure and Linda Eckhardt 28 Feb. 1971 160 p
(Contract NASw-1867; SwRI Proj. 13-2538)
(NASA-CR-121627) Avail: NTIS CSCL 06B

Significant transfers of technology are described. They include an improved method for taking EEG in infants and children with a NASA-developed helmet and electrode system, an infant apnea alarm, an electro-optical call signal for quadriplegic patients activated by head movement, a low cost signal conditioning system which permits recording and playback of ECG signals on a home tape recorder, and a system which permits totally paralyzed patients to use eye movements to control such assist devices as page turners. Significant progress toward several transfers of aerospace technology was made through an in-house applications engineering program. Present efforts are being concentrated upon the completion of a catheter-mounted radiation detector for monitoring cerebral blood flow in head injury patients and probe designed to permit precise measurement of radioactive isotope uptake by eye tumors. Author

N71-34071*# University of Southern Calif., Los Angeles. Dept. of Electrical Engineering.
A STOCHASTIC MODEL FOR EYE MOVEMENTS DURING FIXATION ON A STATIONARY TARGET
R. Vasudevan, A. V. Phatak, and J. D. Smith May 1971 27 p refs
(Grant NGL-05-018-022; GM-16197-03; RR-0712-04; NSF GK-1834X)
(NASA-CR-121640; TR-7I-23) Avail: NTIS CSCL 05E

A stochastic model describing small eye movements occurring during steady fixation on a stationary target is presented. Based on eye movement data for steady gaze, the model has a hierarchical structure; the principal level represents the random motion of the image point within a local area of fixation while the higher level mimics the jump processes involved in transitions from one local area to another. Target image motion within a local area is described by a Langevin-like stochastic differential equation taking into consideration, the microsaccadic jumps pictured as being due to point processes and the high frequency muscle tremor, represented as a white noise. The transform of the probability density function for local area motion is obtained, leading to explicit expressions for their

means and moments. Evaluation of these moments based on the model are comparable with experimental results. A physiologically based criterion for the occurrence of local area changes is assumed and the renewal density of these transitions is obtained. Author

N71-34072*# George Washington Univ., Washington, D.C. Technology Application Group.
APPLICATIONS OF AEROSPACE TECHNOLOGY IN THE PUBLIC SECTOR. AN ANNUAL REVIEW OF THE BIOMEDICAL AND PUBLIC SECTOR TECHNOLOGY APPLICATION TEAM PROGRAM FOR THE PERIOD 1 JUNE 1970 - 31 MAY 1971 Final Report, 19 Jun. 1970 - 20 Jun. 1971
Jun. 1971 199 p refs
(Contract NASw-2055)
(NASA-CR-121638) Avail: NTIS CSCL 06B

The development of mechanisms for facilitating a systematic transfer of NASA technology to nonaerospace sectors is discussed. Major emphasis was placed on establishing viable methodologies and mechanisms for ensuing successful applications of technology in the public sector. The biomedical and public sector team work is reported. E.H.W.

N71-34073*# Dunlap and Associates, Inc., Santa Monica, Calif. Western Div.
VISUAL PERFORMANCE WITH HIGH CONTRAST CATHODE RAY TUBES AT HIGH LEVELS OF AMBIENT ILLUMINATION
W. B. Knowles and J. W. Wulfeck 30 Jun. 1971 74 p refs
(Contract NAS12-2262)
(NASA-CR-114361) Avail: NTIS CSCL 05E

Gap-detection thresholds and working level preferences were determined for one standard and three experimental high-contrast cathode-ray tubes under four levels of ambient illumination, 100, 1,000, 5,000, and 10,000 ft.-c.; two angles of incidence, 30 deg and 60 deg; and two angles of regard, 0 and -45 deg. The trace brightnesses required to perform the visual tasks were primarily a function of the reflectances and resulting background brightnesses of the cathode-ray tube faces. The results are related to classical psychophysical data on brightness discrimination, earlier work on masking luminance for radar displays, and a recent study on visual performance using electroluminescent displays under high ambient illumination. Author

N71-34074*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
SOME SEQUENTIAL, DISTRIBUTION FREE PATTERN CLASSIFICATION PROCEDURES WITH APPLICATIONS
J. L. Poage Jul. 1971 173 p refs
(Grant NGL-22-007-143)
(NASA-CR-121750; TR-2) Avail: NTIS CSCL 06B

Some sequential, distribution-free pattern classification techniques are presented. The classification procedures proposed make use of the theory of order statistics. One of the methods presented is an estimated version of Wald sequential probability ratio test (SPRT). The other method is a sequential version of the separating hyperplane approach to pattern classification. The procedures were tested on Gaussian samples and on the EEG responses. Smaller error rates were easier to obtain with the estimated SPRT. In particular, error rates as low as 0.1% were obtained. With sequential tests, it is possible to specify the probability of error decisions before the test is conducted, and the experimental error rates of the procedures agree with the specified error probabilities. Author

N71-34075*# Missouri Univ., Columbia. Dept. of Biochemistry.
APOLLO DIET EVALUATION, VOLUME 1 Final Report, 7 Jun. 1970 - 7 Jun. 1971
T. D. Luckey [1971] 147 p refs 2 Vol.
(Contract NAS9-10955)
(NASA-CR-115124) Avail: NTIS CSCL 06P

Evaluations of Apollo diets and experimental work on mice to look at morphologic changes are reported. A new approach was developed for the determination of the exact nutrient intake of astronauts during space flights. A comparison of biological and analytical methods, including bioisolation of mice and gamma radiation of diets, indicates that Apollo diet is adequate for mice in isolation and that sterilization of the diet shows no adverse effect. A gnotobiological study revealed adverse reactions in mice when they are fed a diet with limited microflora. These reactions are decreases in body weight, growth rate, adult size, white blood count, and hemoglobin. Other studies include evaluation of health and disease status of the astronaut through fecal indices, the effects of fiber in diets of mice, food preparation time, nutrient indicators, markers in nutrition, and astronaut nutritition for 1, 2, or 3 month space flights. N. E. N.

N71-34076*# Missouri Univ., Columbia. Dept. of Biochemistry.
AN EVALUATION OF NUTRITIONAL MARKERS, VOLUME 2 Final Report, 7 Jun. 1970 - 7 Jun. 1971
A. R. Kotb and T. D. Luckey [1971] 158 p refs 2 Vol.
(Contract NAS9-10955)
(NASA-CR-115125) Avail: NTIS CSCL 06P

The use of markers in nutrition is reviewed, and their characteristics and usefulness are discussed for studies of food intake, food passage, and food absorption in the gastrointestinal tract of man and animals. The techniques of feces sampling, when markers are used, are also discussed. Both external and internal markers are studied. Among the conclusions are the following: The stained particle technique widely used in food studies in ruminants is laborious and questionable. Several dyes have been successfully used to color the feces of ruminants, and a brilliant blue methyl cellulose mixture is recommended for humans. The use of (Cr-51)203, barium sulfate, rare earths, inert metals, soluble markers have been used sucessfully. Of the internal markers, only chromogen and fecal nitrogen seem to be reliable indices to predict digestibility of forage in ruminants it is recommended that the use of glass beads, small seeds, rubber, charcoal, and metal particles in studies of the rate of food passage, and iron oxide, silica, anthraquinone violet, and monastral blue in digestibility studies should cease. N.E.N.

N71-34077*# General Electric Co., Houston, Tex.
CONTROL OF A LIQUID COOLING GARMENT FOR EXTRAVEHICULAR ASTRONAUTS BY CUTANEOUS AND EXTERNAL AUDITORY MEATUS TEMPERATURES
Clay W. G. Fulcher 8 Dec. 1970 328 p refs
(Contract NAS9-10963)
(NASA-CR-115122) Avail: NTIS CSCL 06Q

An improved temperature control concept is developed for liquid cooling garments used during astronaut extravehicular activity. Several modifications and extensions to previously known physiological parameter measurement techniques and control approaches are implemented to provide an automatic controller which responds directly to man's thermoregulatory requirements for cooling during work. The temperature of the wall of the external auditory meatus and four averaged, unweighted skin temperatures are used as input signals to a controller of liquid cooling garment inlet water temperature. The absolute change in derived mean body temperature from a setpoint and its time rate of change are sensed and used to control the temperature of water to an Apollo liquid cooling garment. A crewman metabolic transient thermal computer simulation is conducted to demonstrate feasibility and to supply design parameters for a prototype system. The prototype controller is described and unmanned and manned test data are provided. Author

N71-34078# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CLIMATIC CONDITIONS OF WORK IN PRESSURIZED SUITS [CONDITIONS CLIMATIQUES DE TRAVAIL EN

VETEMENT VENTILE]
Louis Chretien, Yvon Le Bourdonnec, and Bernard Werderer Feb. 1971 45 p refs In FRENCH
(CEA-N-1407) Avail: AEC Depository Libraries

The climatic conditions which exist, under different degrees of work, inside a pressurized suit, usually worn at the Centre d'Etudes Nucleaires de Saclay, are described. After a brief review of the physical conditions influencing the gain or loss of metabolic heat from human body, the various relations concerning heat convection and absorption are given, as well as those related to sweat removal. The equations are solved by a graphic method that lead to diagrams which, for a given work situation, and as a function of air flow, give the index of thermal stress. This index indicates the thermal environment to which the wearer is exposed. The diagrams are in agreement with published experimental observations. NSA

N71-34079*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AUTOMATIC INSTRUMENT FOR CHEMICAL PROCESSING TO DETECT MICROORGANISMS IN BIOLOGICAL SAMPLES BY MEASURING LIGHT REACTIONS Patent Application
Burton N. Kelbaugh, inventor (to NASA), Grace L. Picciolo, inventor (to NASA), Emmett Chappelle, inventor (to NASA), and Maurice E. Colburn, inventor (to NASA) Filed 30 Apr. 1971 9 p
(NASA-Case-GSC-11169-2; US-Patent-Appl-SN-139094) Avail: NTIS CSCL 06B

An automated apparatus for sequentially assaying urine samples for the presence of bacterial adenosine triphosphate (ATP) is described. The apparatus comprises a rotary table which carries a plurality of sample containing vials; a dispensing means which automatically dispense fluid reagents into the vials at predetermined times preparatory to injecting a light producing luciferase-luciferin mixture into the samples; and an indicating means which automatically measures the light produced in each urine sample by a bioluminescence reaction of the free bacterial adenosine triphosphate with the luciferase-luciferin mixture. The light measured is proportional to the concentration of bacterial adenosine triphosphate which, in turn, is proportional to the number of bacteria present in the respective urine sample. After the light measurement is performed, the vials are ejected from the table. NASA

N71-34080*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RESTRAINT SYSTEM FOR ERGOMETER Patent Application
Raymond L. Gause, inventor (to NASA) and Raymond A. Spier, inventor (to NASA) Filed 25 Jun. 1971 10 p
(NASA-Case-MFS-21046; US-Patent-Appl-SN-156725) Avail: NTIS CSCL 06B

A restraint system for securing a person to an ergometer while exercising under zero gravity conditions or while operating the ergometer in earth environment in a position other than the upright position is described. A padded, form-fitting body belt fits around the operator's waist and suspenders are attached to the body belt. The body belt is secured to the ergometer forwardly and rearwardly of the ergometer seat by adjustable belts joined to the body belt and releasably hooked to the ergometer frame. NASA

N71-34081# RAND Corp., Santa Monica, Calif.
APPLICATIONS OF ADVANCED TECHNOLOGY TO UNDERGRADUATE MEDICAL EDUCATION
J. A. Farquhar, R. Bretz, A. S. Ginsberg, T. L. Lincoln, R. J. Mellone et al Apr. 1970 90 p refs Sponsored by NIH
(RM-6180-NLM) Avail: NTIS

Undergraduate medical education and the ways in which advanced technology might bring about substantial changes in both the quantity and quality of graduates are discussed. Five such applications are described including computer-assisted instruction; computer-assisted self-evaluation; an ultra-microfiche retrieval and display system; electronic video recording; and two multimedia aids known as the clinical encounter simulator and the patient management decision aid. The goals of applying technology to medical education are summarized, and questions are raised that must be answered prior to any attempt at widespread implementation of the systems described. Author

N71-34082# RAND Corp., Santa Monica, Calif.
BIOSCIENCES AT RAND
Edward C. DeLand, ed., Carl Gazley, Jr., ed., and Linda Colbert, ed. Jun. 1970 76 p refs
(RM-6047-RC) Avail: NTIS

Research in the biosciences-biochemistry, biophysics, biomathematics, and bioengineering are described. Data cover (1) physiological modeling projects, (2) mechanisms and neurophysiology of human vision, pattern recognition, and enhancement, and (3) clinical application and diagnostic techniques. An extensive bibliography is included. E.H.W.

N71-34083# Federal Aviation Administration, Oklahoma City, Okla. Civil Aeromedical Inst.
EVALUATION OF AN IMPROVED FLOTATION DEVICE FOR INFANTS AND SMALL CHILDREN
Ernest B. McFadden and Joseph W. Young Jul. 1971 10 p refs
(FAA-AM-71-37) Avail: NTIS

A simple, lightweight, life-support infant flotation device incorporating reliable self-righting, thermal protection and automatic self-ventilation is described. This design concept utilizes prior data relative to the centers of gravity of infants and small children and exhibits excellent self righting. Thermal protection is incorporated through the use of insulative neoprene foam in construction of the submerged portion of the device. Anesthetized adolescent primates exhibiting body weights and metabolic requirements equivalent to that of an infant or small child were used to test and confirm ventilatory capability as induced by air or water motion. An evaluation of the capability of the device to deter shark attack indicated that the infant flotation device, when occupied by anthropomorphic dummies or anesthetized primates, was less attractive to sharks than anthropomorphic dummies wearing a standard yellow color inflatable life vest. Author

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-34084*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
LASER INDUCED GAS BREAKDOWN: SPECTROSCOPIC AND CHEMICAL STUDIES
Philippe de Montgolfier 21 Jun. 1971 55 p refs Supported in part by CEA
(Grant NGL-50-002-001)
(NASA-CR-121646; WIS-TCI-442X) Avail: NTIS CSCL 07D

The results are given of several investigations on laser-induced gas breakdown. These experiments included time resolved spectroscopy, direct detection of H atoms, and chemical reactions, and provided insight into the behavior of the medium at different times. Comparison of the intensity of the observed signals showed that the species formed were probably created during collisions with electrons. No primary multiphotonic absorption and no macroscopic chemical reaction were observed below the breakdown threshold. Author

N71-34085*# California Univ., Berkeley. Sea Water Conversion Lab.
STUDY OF PERMEABILITY CHARACTERISTICS OF MEMBRANES Quarterly Report
K. S. Spiegler, R. M. Messalem, R. J. Moore, and J. Leibovitz 15 Jan. 1971 70 p refs Prepared for JPL
(Contracts NAS7-100; Contract JPL-952109)
(NASA-CR-121634; QR-12) Avail: NTIS CSCL 07D

Instrumentation was developed with which the transport of salt, ions, and water across membranes can be determined accurately and unambiguously with differences in concentration, electrical potential, and pressure as driving forces, together with the measurement of membrane potential and streaming potential. Water and salt permeabilities were calculated and compared with the results of previous research. It was found that there is fair agreement with those measured with the concentration-clamp method. Author

N71-34086*# Pittsburgh Univ., Pa. Space Research Coordination Center.
WATER CLUSTER FORMATION RATES OF NO+ IN He, Ar, N2 AND O2 AT 296 K
Carleton J. Howard, Howard W. Rundle, and Frederick Kaufman 14 Jul. 1971 15 p refs
(Grant NGL-39-011-002)
(NASA-CR-121713; SRCC-154) Avail: NTIS CSCL 07D

Reaction rates of NO(+) and its hydrates, NO(+) - nH2O (n = 1 to 3), with water were measured in a flow system. The mechanism for conversion of NO(+) hydrates to H3O(+) hydrates was confirmed, and rate constants for the sequence of six clustering, redissociation, and rearrangement reactions were determined for each of the four carrier gases He, Ar, N2, and O2. Author

N71-34087*# Wisconsin Univ., Madison.
CLASSICAL STUDY OF ROTATIONAL EXCITATION OF A RIGID ROTOR: Li+ PLUS H2
Robert A. La Budde and Richard B. Bernstein 18 Jun. 1971 80 p refs
(Grants NGL-50-002-001; NSF GB-16665)
(NASA-CR-121729; WIS-TCI-433) Avail: NTIS CSCL 07D

Classical calculations are presented for a model problem simulating the rotational excitation of H2 (and D2) in collision with Li(+), based upon the potential surface of Lester. The hydrogen molecule was taken to be a rigid rotor, even though this assumption becomes progressively worse as the collision energy is increased and the vibrational excitation threshold is crossed. However, the results should serve as a set of reference calculations on a well-defined system, suitable for comparison with semiclassical and quantal treatments. The influence of initial rotational state, molecular mass, and collision energy upon the angular distribution of the average rotational energy transfer and total inelasticity is evaluated and discussed. Author

N71-34088*# Pennsylvania Univ., Philadelphia. School of Chemical Engineering.
STUDY OF THE ZINC-SILVER OXIDE BATTERY SYSTEM Quarterly Report, Apr. - Jun. 1971
Leonard Nanis Jun. 1971 78 p refs
(Contract NAS7-100)
(NASA-CR-121704) Avail: NTIS CSCL 07D

Porous electrode and silver-oxide electrode developments in the study of zinc-silver oxide battery systems are summarized. Membrane permeation, the capillary diffusivity model, and diffusivity measurements are also discussed. J.M.

N71-34089*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THERMOPHYSICAL PROPERTIES OF OXYGEN FROM THE FREEZING LIQUID LINE TO 600 R FOR PRESSURES TO 5000 psia Final Report, Jan. - Jun. 1971
Robert D. McCarty and Lloyd A. Weber Jul. 1971 190 p refs
(NASA Order T-1813A)
(NASA-CR-121739; NBS-TN-384) Avail: NTIS; SOD $1.50 CSCL 07D

Tables of thermophysical properties of oxygen are presented for temperatures from the melting line to 600 R and for pressures to 5000 psia. The tables include, entropy, enthalpy, internal energy, density, volume, speed of sound, specific heat, thermal conductivity, viscosity, thermal diffusivity, Pandtl number and the dielectric constant for 79 isobers. Also included in the isobaric tables are quantities of special utility in heat transfer calculations. In addition to the isobaric tables, tables for the saturated vapor and liquid are given which include all of the above properties, plus the surface tension. Tables for the P-T of the freezing liquid, index of refraction and the derived Joule-Thomson inversion curve are also presented. The specific heat of the saturated liquid is given in graphical form. A temperature-entropy chart and a Mollier diagram are also included. Author

N71-34090*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NONDISPERSIVE GAS ANALYZING METHOD AND APPARATUS Patent Application
John Dimeff, inventor (to NASA) Filed 16 Apr. 1971 25 p
(NASA-Case-ARC-10308-1; US-Patent-Appl-SN-134568) Avail: NTIS CSCL 07D

A nondispersive infrared gas analyzer composed of first and second variable volume containers is described. The first container is used to receive the reference gas and the second is used to receive the unknown gas. Means are also provided to differentially vary gas density in the containers, cause radiation to pass serially through the containers, and detect radiation intensity emerging from the second container and generating a reponsive radiation signal. An electronic device is also present which selects and displays a particular component of the radiation signal. NASA

N71-34091# Los Alamos Scientific Lab., N. Mex.
ELECTROPHYSICAL PROPERTIES AND NATURE OF THE CHEMICAL BOND IN COMPOUNDS OF BERYLLIUM WITH BORON AND CARBON
V. S. Neshpor et al Apr. 1971 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Neorg. Mater. (USSR), no. 7, 1971 p 50-55 Sponsored by AEC
(LA-tr-71-30) Avail: NTIS

Results of investigations show that the resistivity of beryllium borides increases uniformly with increase in the relative content of boron, from the values characteristic for metallic conductors, for the lower borides, to the values characteristic for insulators, for the higher borides of beryllium. The structure and electrophysical properties of the lower borides of beryllium are determined by means of the beryllium bonds, mainly of a metallic type, with a low degree of localization of the s-electrons of beryllium. The structure and electrophysical properties of the higher borides of beryllium are determined by a motif of the boron bonds of the covalent type. The beryllium atoms in these compounds are electron donors, stabilizing the sp3-electron configurations of boron and, in their turn, take on stable s0-configurations. Between the electron configurations of beryllium which are higher on the energy scale and the electron configurations of boron there is an energy gap, which causes their electric insulating properties. Author (NSA)

N71-34092*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RATE MEASUREMENTS FOR THE REACTION OF HYDROGEN CHLORIDE AND DEUTERIUM CHLORIDE WITH ATOMIC OXYGEN
Edgar L. Wong and Frank E. Belles Washington Sep. 1971 p refs
(NASA-TN-D-6495; E-6234) Avail: NTIS CSCL 07D

A mass spectrometric stirred reactor technique was used to measure the rate of the O + HCl yields OH + Cl reaction for

the temperature range of 356 to 628 K. Reaction products observed were Cl-atom, O2, H2, some H2O, and a trace of Cl2. The rate constant was found to be (1.13 + or - 0.16)x 10 to the 13th power e to the (-7100 + or - 130)/RT power cu cm/mole/sec. The corresponding reaction O + DCl yields OD + Cl was also investigated and its rate constant was found to be (3.74 + or - 0.60)x 10 to the 12th power e to the (-6800 + or - 170)/RT power cu cm/mole/sec. On the basis of the H2O produced in the O + HCl reaction an activation energy of about 21,000 J/mole (5000 cal/mole was obtained for the OH + HCl yields H2O + Cl reaction. Author

N71-34093# American Chemical Society, Columbus, Ohio.
FIFTEENTH CHEMICAL ABSTRACTS SERVICE: OPEN FORUM
Jul. 1971 24 p Conf. held at Los Angeles, 30 Mar. 1971
Avail: NTIS

CONTENTS:

1. INTRODUCTION G. A. Wilson p 1-4 (See N71-34094 21-06)

2. INTELLECTUAL ORGANIZATION OF THE CHEMICAL ABSTRACTS SUBJECT INDEX P. E. Swartzentruber p 5-10 (See N71-34095 21-06)

3. COMPUTER PROCESSING OF INFORMATION FOR INDEXES AND INDEX FILES R. A. Flick p 11-16 (See N00-00023 21-06)

N71-34094# American Chemical Society, Columbus, Ohio.
INTRODUCTION
Gary A. Wilson *In its* Fifteenth Chem. Abstr. Serv. Jul. 1971 p 1-4 (See N71-34093 21-06)
Avail: NTIS

The computer system developed to organize the information contained in the subject indexes and a new computer-readable integrated subject file are discussed. In the processing steps of analyzing the document, keyboarding the data, and examining and correcting the magnetic tape by editing subroutines, emphasis is placed on establishing a reliable computer record. In the packaging step, the emphasis is on organizing the records in ways that make chemical sense. N.E.N.

N71-34095# American Chemical Society, Columbus, Ohio.
INTELLECTUAL ORGANIZATION OF THE CHEMICAL ABSTRACTS SUBJECT INDEX
Paul E. Swartzentruber *In its* Fifteenth Chem. Abstr. Serv. Jul. 1971 p 5-10 (See N71-34093 21-06)
Avail: NTIS

The organization of the subject index geared specifically towards chemistry, and the problems involved in converting the process from a manual to a computer-based operation are discussed. The manual sorting and formatting of entries, and special consideration in computer-based sorting and formatting are described. N.E.N.

N71-34096# American Chemical Society, Columbus, Ohio.
COMPUTER PROCESSING OF INFORMATION FOR INDEXES AND INDEX FILES
Robert A. Flick *In its* Fifteenth Chem. Abstr. Serv. Jul. 1971 p 11-16 (See N71-34093 21-06)
Avail: NTIS

The computer methods used to select, sort, and format the chemical compound entries in the subject indexes are discussed briefly. The computer-readable, sorted intergrated subject file is also described. N.E.N.

N71-34097# Reactor Centrum Nederland, Petten.
DETERMINATION OF OXYGEN TO URANIUM RATIO IN HYPERSTOICHIOMETRIC URANIUM DIOXIDE
A. Tolk and W. A. Lingeraak Sep. 1970 16 p refs
(RCN-127) Avail: AEC Depository Libraries

The following chemical procedure is preferred for the determination of the O/U ratio in hyperstoichiometric uranium dioxide. The sample is dissolved in concentrated phosphoric acid without change in uranium valence. Then the amount of U(6) present in the solution is titrated with an Fe(2) standard solution in phosphoric acid. The titrimetric end-point is detected following the dead-stop-end-point procedure. When special precautions are taken, the O/U value can be determined with an accuracy and precision of + or - 0.0001 O/U units when 500-mg sample aliquots are used. Author (NSA)

N71-34098# Technische Hogeschool, Eindhoven (Netherlands).
ON THE POLYMERIZATION OF SULFUR AND SELENIUM IN THE LIQUID STATE: AN ESR STUDY
Diederik Christiaan Koningsberger (Ph.D. Thesis) 19 Mar. 1971 136 p refs
Avail: NTIS

The polymerization equilibrium of sulfur and selenium in the liquid state was described, and the polymerization equilibrium of iodine-doped sulfur was studied. To obtain information on the reaction rate constants from the linewidth of the ESR signals, the influence of the linewidth on the reaction rate constants of three possible reaction mechanisms were calculated. A lineshape analysis was developed to investigate the kinetic process and the number of spins from the ESR measurements. From the literature theoretical and experimental curves for the weight fraction polymer of sulfur were obtained, and their validity was investigated with the help of the ESR measurements and the polymerization theory. Combining the equilibrium and kinetic data obtained from the results of the ESR experiments, it was concluded that the ring-addition reaction determines the way in which the polymerization equilibrium of liquid sulfur and liquid selenium is reached. The ESR measurements carried out on sulfur samples doped with different amounts of iodine, support the polymerization theory as developed for liquid pure sulfur. Author

N71-34099# California Univ., Berkeley. Lawrence Radiation Lab.
DIFFUSION AND MIGRATION IN ELECTROCHEMICAL SYSTEMS
Hsueh Limin Mar. 1971 190 p refs Revised
(Contract W-7405-eng-48)
(UCRL-18597-(Rev)) Avail: NTIS

The limiting current and concentration profile in a stagnant diffusion cell are calculated for a concentrated copper sulfate solution with consideration of the variation of physical properties and nonzero interfacial velocity. The calculated concentration profile is compared with that observed optically in a cell with a stagnant electrolyte at the limiting current. The possibility and the method for obtaining differential diffusion coefficients from the limiting current measurements are explored. The use of integral diffusion coefficients in multicomponent electrolytic solutions at high Schmidt numbers is justified on the basis of hydrodynamic considerations. Integral diffusion coefficients are measured by a rotating disk and a stagnant diffusion cell over a concentration range of copper sulfate 0.01M to 0.6M, and sulfuric acid 0.0 to 2.5M. In a copper sulfate, sulfuric acid solution, sulfate ions as well as bisulfate ions are present in the solution as anions. The effect of migration on the limiting current and the concentration difference between bulk and surface is measured and compared with calculated values from the incomplete dissociation of bisulfate ions. Author

N71-34100# California Univ., Berkeley. Lawrence Radiation Lab.
MIGRATION IN SUPPORTED ELECTROLYTE SOLUTIONS WITH FREE CONVECTION
Jan Robert Selman and John Newman Jan. 1971 144 p refs
(Contract W-7405-eng-48)
(UCRL-20322) Avail: NTIS

The migration contribution to the current in free convection is evaluated by numerical solution of the appropriate partial

differential equations, with the assumption that the Schmidt number is very high. Results are presented for the systems CuSO4 - H2SO4 - H2O and K3Fe(CN)6 -K4Fe(CN)6 - KOH(NaOH) - H2O. In all cases, except in the unsupported systems, there occurs a density maximum as well as a minimum, which leads to a velocity maximum within the diffusion layer. In a well-supported ferri-/ferrocyanide system, this density inversion is strong enough to cause physically implausible results. The composition at the electrode and the shear stress were also obtained in the course of the computation. Author

N71-34101# California Univ., Berkeley. Lawrence Radiation Lab.
ASYMMETRIC INTERACTIONS AND THE SEPARATION OF OPTICAL ISOMERS BY OPTICALLY ACTIVE SORBENTS
John M. Krochta, David R. Buss, and Theodore Vermeulen Mar. 1971 96 p refs
(Contract W-7405-eng-48)
(UCRL-20471) Avail: NTIS

Stereospecific sorption was studied as an alternate method to better known procedures for separating optical isomers. Pure optical isomers of aspartic acid were found to dissolve in measurably different amounts into aqueous solutions of other amino acids, used as optically active solvents. The largest observed effect was a 1.1% difference for the aspartic acid isomers in 0.05M glutamic acid. Such differences in optical isomer solubilities are explained by differences in binary association between solute and solvent, caused by structural effects which alter the bonding strength at the third of three points of intermolecular contact. Analysis of solubility and activity data yielded a value close to 0.20/(moles/liter) for the dimerization constant describing quadrupole formation between two different amino acids. Author

N71-34102# Martin Marietta Corp., Baltimore, Md. Research Inst. for Advanced Studies.
PHOTOCHEMISTRY AND ENZYMOLOGY OF PHOTOSYNTHESIS Technical Report, 1 Feb. 1970 - 30 Apr. 1971
[1971] 13 p refs
(Contract AT(30-1)-3706)
(RIAS-3706-16) Avail: NTIS

Continuing research on the function of Mn in o2 evolution is reported. Investigations were concerned with the mechanisms of: (1) inhibition of o2 evolution by NH2oH, and (2) photoactivation of the Mn catalyst of o2 evolution. The results obtained in the studies are summarized. D.L.G.

N71-34103# Los Alamos Scientific Lab., N. Mex.
MONTE CARLO TRAJECTORIES: THE DYNAMICS OF THE REACTION F PLUS H2
N. C. Blais Jan. 1971 9 p refs Sponsored by AEC
(Contract W-7405-eng-36)
(LA-4603) Avail: NTIS

About 1200 reactive collisions of fluorine atoms with hydrogen molecules are obtained by numerical solution of classical equations of motion. A modified London equation represents the interatomic potential energy, and Monte Carlo procedures are used to start each collision trajectory except the initial velocity of approach. This collision energy is fixed for each of four runs at 1.0, 2.0, 4.0, and 8.0 Kcal/mole. The resulting distributions indicate that the average cross sections for the reaction leading to vibration states of HF v = 3,2,1, and 0 are 1.0:0.6:0.2:0.0, respectively. These ratios vary slightly with initial energy. Rotational energy is also high, with characteristic temperatures from 1300 deg to 4600 deg K, depending on initial energy. The differential scattering cross section varied rapidly with energy from strong backward scattering at low energies to forward scattering at the highest energy used. Author

N71-34104# Technische Hochschule Munchen (West Germany).
A SYSTEM FOR STUDYING FAST REACTION KINETICS [EIN SYSTEM ZUR UNTERSUCHUNG DER KINETIK SCHNELLER REAKTIONEN]
Norbert Merget (Ph.D. Thesis) 19 Oct. 1970 16 p refs In GERMAN
Avail: NTIS

A molecular beam system is described for the study of fast reactions in gaseous phases with velocity constants of about 10 to the 10th power ccm/mol per second. The apparatus consists of a beam channel, a molecular beam system with pumping equipment for the ion source deposition, and a high resolution mass spectrometer as indicating equipment. Transl. by G. G.

N71-34105 Clemson Univ., S.C.
SYNTHESIS AND PROPERTIES OF METAL CHELATES FOR POLYMERIZATION STUDIES
Kenneth Bedros Takvorian (Ph.D. Thesis) 1969 186 p
Avail: Univ. Microfilms Order No. 70-17455

The feasibility of forming condensation polymers of substituted metal acetylacetonates was investigated. New routes were developed for the synthesis of 3-benzyl-2,4-pentanedione and 3-phenyl-2,4-pentanedione chelates. These derivatives, however, proved inert to conventional aromatic condensation reactions. A decomposition to boron complexes occurred in attempted acetylation reactions. Mixed ring complexes of 2,4-pentanedione and 3-substituted 2,4-pentanediones were prepared. Formaldehyde condensation reactions of these derivatives led to cyclic monomeric and dimeric derivatives. Chemical and physical data of the monomer systems are compiled. The diamagnetic and paramagnetic contributions to shielding are elucidated in the NMR spectra of the substituted systems. Transesterification reactions of aluminum(III), chromium(III), and copper(II) ethylacetoacetate chelates were investigated. Only the aluminum derivatives proved reactive. Dissert. Abstr.

N71-34106 Cornell Univ., Ithaca, N.Y.
THE KINETICS OF THE FREE RADICAL INITIATED COPOLYMERIZATION OF 1-VINYL-3,5-DIMETHYL ADAMANTANE AND VINYL ACETATE AND THE GLASS TRANSITION TEMPERATURES OF THE RESULTANT COPOLYMERS
Richard Stanley Miller (Ph.D. Thesis) 1970 505 p
Avail: Univ. Microfilms Order No. 70-17468

Free radical initiated copolymerizations of 1-vinyl-3,5-dimethyl adamantane (1) and vinyl acetate (2) were studied as a function of temperature. A nuclear magnetic resonance technique was used to estimate copolymer composition. An Arrhenius activation energy difference of 9.08 kcal/gmole was found to exist between E11 and E12. No activation energy difference was found to exist between E22 and E21. The preexponential factors for all polymerizations were assumed to be equal in the analysis. A digital computer program correcting for monomer conversion was used to estimate the relative reactivity ratio. The glass transition temperatures and number average molecular weights of the 1-vinyl-3,5-dimethyl adamantane-vinyl acetate copolymers were used in conjunction with the Gibbs-DiMarzio theory of the glass transition temperature to estimate the average difference in the lowest rotational energy levels of a 1-vinyl-3,5-dimethyl adamantane homopolymer. Dissert. Abstr.

N71-34107 California Univ., Los Angeles.
THE HIGH-PRESSURE METALLIC POLYMORPHS OF INDIUM ANTIMONIDE, CADMIUM TIN DIARSENIDE, AND CADMIUM ARSENIDE
Howard Allan Katzman (Ph.D. Thesis) 1970 133 p
Avail: Univ. Microfilms Order No. 70-19859

The heat capacity at constant pressure of indium antimonide (II) between 80 deg and 100 K was found to be identical to that of beta-tin at the same temperatures. InSB(II) is a high pressure metallic polymorph which can be retained at

atmospheric pressure and low temperatures. It is isoelectronic with tin and its structure and lattice parameters have been found to be identical to beta-tin. The isothermal compressibility of both beta-tin and InSB(II) were measured at about 140 K and data were found indicating that their compressibilities are actually much more similar than previously reported. High pressure superconducting polymorphs of cadmium tin diarsenide (CdSnAs2) and cadmium germanium diarsenide (CdGeAs2) were produced, both of which can be retained at atmospheric pressure and room temperature. A high pressure metallic polymorph of cadmium arsenide (Cd3As2(III)) was also retained and studied at atmospheric pressure and low temperatures. Dissert. Abstr.

N71-34108 Ohio State Univ., Columbus.
APPLICATIONS AND DEVELOPMENT OF THIN LAYER ELECTROCHEMISTRY EMPLOYING TWIN DROPPING MERCURY ELECTRODES
Michael Larry Rose (Ph.D. Thesis) 1970 208 p
Avail: Univ. Microfilms Order No. 70-19355

A newly developed technique in thin layer electrochemistry employing twin dropping mercury electrodes is investigated. Theoretical equations have been derived for both steady-state and transient current response of the thin layer. The technique has been applied to a real system and the transient current response equation verified for dependence on concentration, electrode spacing and electrode area. The technique was also applied to a real kinetic system. The response of the cell followed the theoretically predicted behavior from k = 0.5 to 5.0/sec. Finally the technique was used to look for unstable intermediates in the reduction of Ni(II) in various complexing media. Some evidence was found for lower valence nickel species in cyanide media and in saturated calcium chloride media. The instrument used in this investigation contained several interesting features including modularity, programmability, and versatility. One additional feature described was the ability to control potentials and currents of multielectrode cells with the use of only one reference and one auxiliary electrode.
Dissert. Abstr.

N71-34109 Purdue Univ., Lafayette, Ind.
SOME CHEMISTRY OF THE SILICON METAL BOND
Joseph Charles Sendra (Ph.D. Thesis) 1970 88 p
Avail: Univ. Microfilms Order No. 70-18731

The trichlorosilyl mercurial reacts with compounds containing a metal-hydrogen bond to form new chlorosilyl-metal derivatives. Preparations are described for (trichlorosilyl) trimethyl stananne, (trichlorosilyl) trichorogermane, (trimethyl silylmethyl) trichlorogermane, and (trichlorogermyl) trichlorosily mercury. The reaction between the chlorosilyl mercurial and aluminum yielding a silicon aluminum compound was examined. The preparation of trichlorosilyl manganese pentacarbonyl in the reaction of manganese decacarbonyl and the silyl mercurial is described.
Dissert. Abstr.

N71-34110 Colorado Univ., Boulder.
DIFFERENTIAL SCANNING MICROCALORIMETRY
Harrison Bernard Albert (Ph.D. Thesis) 1969 197 p
Avail: Univ. Microfilms Order No. 70-16460

Differential scanning microcalorimetry is an experimental and computational approach to the problem of measuring and evaluating heat effects caused in a liquid chemical sample by elevation of its temperature. A typical experiment, with temperature scan from -5 to 55 C, takes 10 hours, using a scanning rate of 6 degrees per hour. To reduce systematic errors, a differential instrument configuration is used where a sample cell is balanced thermally against a reference cell. Microcalorimetry is calorimetry in which special care is taken to reduce the errors in heat measurement. Techniques and apparatus for shielding a microcalorimeter from its laboratory environment were evaluated. A combination of massive concentric metal shields with electronic regulation of heating to control the temperature of those shields was found to work well. An instrument was developed for control and indication of electrical cell heating in calorimeters. Dissert. Abstr.

N71-34111 Louisiana State Univ., Baton Rouge.
STUDIES OF CAVITIES CONTAINING ONE AND TWO ELECTRONS IN METAL-AMMONIA SOLUTIONS. 1. ACCURATE EFFECTIVE INTERMOLECULAR PAIR POTENTIALS IN GASEOUS ARGON. 2
David Anthony Copeland (Ph.D. Thesis) 1970 135 p
Avail: Univ. Microfilms Order No. 70-18523

Models with twelve and eighteen molecules in the first coordination shell and a continuum beyond the first layer were studied. Electron-molecule and molecule-molecule interactions are considered. The electron-dipole interactions are the greatest stabilizing factor, while the hydrogen-hydrogen interactions of the surface molecules determine the cavity size in most cases. The temperature dependence and assymetry of the spectra are considered. Three-body nonadditive corrections to various assumed argon-argon potentials were investigated. For intermediate gaseous argon densities, the triple-dipole interaction is the major correction for many-body interactions.
Dissert. Abstr.

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-34112*# George Washington Univ., Washington, D.C. Technology Applications Group.
REVIEW OF FEDERAL RESEARCH AND DEVELOPMENT IN COMMAND/CONTROL CENTER DESIGN
2 Aug. 1971 55 p refs
(Contract NASw-2085)
(NASA-CR-121639) Avail: NTIS CSCL 17B

Information gathered of Federal; R&D efforts directly relevant to command/control center design is summarized. The methodology for this investigation consisted of:(1) reviewing information currently available and conducting information searches to identify relevant funders and performers of relevant R&D;(2) contacting identified Federal agency representatives to fully identify pertinent R&D effort; (3) contacting Federal agency and law enforcement organization personnel to determine characteristics of current and planned advances in technology state-of-the-art; and(4) reviewing pertinent publications. Author

N71-34113*# Bellcomm, Inc., Washington, D.C.
A PHASE LOCKED LOOP DEMODULATOR FOR TELEVISION TYPE PM SIGNALS
W. D. Wynn 5 May 1971 49 p refs
(Contract NASw-417)
(NASA-CR-121724; TM-71-2034-1) Avail: NTIS CSCL 17B

A tractable suboptimum demodulator in a phase-locked loop configuration was developed for demodulating a model of a television signal received as phase modulation on a sinusoidal carrier. The available waveform at the demodulator input is assumed to be the sum of the phase modulated carrier and a stationary Gaussian noise. The suboptimum demodulator is suggested by using the Wiener spectrum factorization technique to find the transmission poles and zeros of the optimum linear loop filter. A simple linear filter is then shown to approximate the infinite number of optimum loop poles and zeros that arise due to the complicated signal model used. Although the optimum demodulator is not derived, its mean square estimation error is computed and is compared to the estimation error for the suboptimum demodulator. Author

N71-34114*# Case Western Reserve Univ., Cleveland, Ohio. Div. of Fluid, Thermal and Aerospace Sciences.
THE PROPAGATION OF WAVES IN INHOMOGENEOUS

MEDIA
Aminul Haq and Wilbert J. Lick Jun. 1971 152 p refs
(Grant NGR-36-003-064)
(FTAS/TR-71-59; NASA-CR-121733) Avail: NTIS CSCL 20N

The propagation of linear waves in an inhomogeneous medium is investigated. The analysis has been restricted to media where the inhomogeneity is only along one direction of a rectangular coordinate system. The governing equation that is obtained does not admit of closed form or exact solutions unless the index of refraction is of some particular form. It has been the purpose of this investigation to obtain approximate solutions or solutions in the form of series, in order that some estimate might be made of the amplitudes of the reflected and transmitted waves that are produced due to a wave incident on media with different types of inhomogeneities. The WKB solution suggested new dependent and independent variables which enabled solutions to be obtained that overcame the essential shortcoming of the WKB method. Problems with single turning points of the first or second order were also considered. Author

N71-34115*# TRW Systems Group, Redondo Beach, Calif. Communications and Sensor Systems Dept.
NEW CRITERIA DEVELOPMENT
J. C. Miller 29 Jun. 1971 83 p refs
(Contract NAS9-8166)
(NASA-CR-115079; TRW-17618-H174-R0-00) Avail: NTIS CSCL 17B

Several methods of specifying performance criteria for voice, video, and digital data systems are described and evaluated. Some general characteristics for each category were determined which are common to most systems considered. The characteristics were used to arrive at particular choices for test criteria in each system category. The method employed was to propose several candidate evaluation systems in each category, and make an evaluation of each system based on a number of parameters including precision of test data, conciseness of results, required data reduction, pertinence to actual system performance, and ease of simulation. Each of the parameters was assigned a relative weighting value. In order to evaluate the candidate systems, the factors affecting each of the performance parameters of each of the candidate systems were listed, and a numerical rating value was assigned to each. By this procedure an overall score for each of the candidate systems was achieved which provided the basis for the recommendations concerning the methods of specifying performance criteria. Author

N71-34116*# North Carolina State Univ., Raleigh.
STUDY OF RECTANGULAR-GUIDE-LIKE STRUCTURES FOR MILLIMETER WAVE TRANSMISSION Progress Report, period ending 30 Jun. 1971
Frederick J. Tischer 2 Apr. 1971 162 p refs
(Grant NGL-34-002-047)
(NASA-CR-121859; PR-A) Avail: NTIS CSCL 20N

The effects of surface roughness on conduction losses were investigated by measuring roughness parameters of metallic surfaces by an optical technique and correlating them with the measured quality factors of two types of resonators at 35 GHz. Using a demountable rectangular structure for a conventional and a closed H-guide resonator, variations in surface losses with surface roughness were measured. The derivations of Q-values for the two resonators showed that the fields in the closed H-guide provided an improved method for measuring surface losses as a function of surface roughness. The side walls of the resonator were the only sections removed from the test structure, and the surface roughness created on the side walls by abrasive polishing was measured by the optical technique. Included in the study were observations of the effects caused by electropolishing and other types of surface preparation. Author

N71-34117*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
STUDY OF RECTANGULAR-GUIDE-LIKE STRUCTURES FOR MILLIMETER WAVE TRANSMISSION Final Report, period ending 30 Jun. 1971
Frederick J. Tischer 2 Apr. 1971 84 p refs
(Grant NGL-34-002-047)
(NASA-CR-121856; PR-B) Avail: NTIS CSCL 20N

An evaluation of the propagation characteristics of the fence guide was made using data obtained from field measurements. Changes of these propagation characteristics caused by dielectric loading were investigated. Two prototype guides with several loading configurations were studied. A new technique in automated field-probe measurements was used to obtain very accurate field-distribution plots. Author

N71-34118*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK, VOLUME 4 Progress Report, May - Jun. 1971
15 Aug. 1971 223 p refs
(Contract NAS7-100)
(NASA-CR-121717; JPL-TR-32-1526-Vol-4) Avail: NTIS CSCL 17B

Progress reports are presented on Deep Space Network (DSN) supporting research and technology, advanced development and engineering, and operations pertaining to mission-independent or multiple-mission development, as well as to support flight projects. For individual titles, see N71-34119 through N71-34154.

N71-34119*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 1-3 ref (See N71-34118 21-07)
Avail: NTIS CSCL 17B

The objectives, functions and organization of the Deep Space Network are summarized. The Deep Space Instrumentation Facility, the Ground Communications Facility, and the Space Flight Operations Facility are described. Author

N71-34120*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN TELEMETRY SYSTEM
E. S Burke and C. W. Harris *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 4-10 (See N71-34118 21-07)
Avail: NTIS CSCL 09F

The telemetry system analysis group is responsible for analyzing the total performance of the DSN telemetry system. The group's tasks include both real time and nonreal time functions. By combining these two functions, the telemetry system can be analyzed for short- and long-term performance. This is illustrated by data results which were accumulated during real time operations for the solar occultation of Pioneer 9, and compiled and analyzed during nonreal time periods. Author

N71-34121*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN MONITOR SYSTEM
J. E. Maclay *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 11-12 ref (See N71-34118 21-07)
Avail: NTIS CSCL 17B

The Deep Space Network monitor system is now operational. The system was significantly changed during the moving process into the Space Flight Operations Facility (SFOF) IBM 360/75 computers. The display capability is much greater than that available in the previous monitor system design. Additionally, SFOF and Ground Communications Facility monitoring provisions are augmented over the previous design. Author

N71-34122*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PIONEER MISSION SUPPORT

A. J. Siegmeth *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 13-21 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17B

The Deep Space Network (DSN) is preparing for the tracking and data acquisition support of Pioneers F and G. The major objective is to produce an effective data return capability from the vicinity of Jupiter. The spacecraft's internal data flow design is described, and the interfaces between the spacecraft and the DSN data system are identified. Author

N71-34123*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HELIOS MISSION SUPPORT
P. S. Goodwin *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 22-31 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17B

The spacecraft's radio subsystem is described, including interrelationships between spacecraft design and the planned capabilities of the Deep Space Network. A functional description of the Helios telemetry system is also provided. Author

N71-34124*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 MISSION SUPPORT
R. P. Laeser *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 32-39 (See N71-34118 21-07)
Avail: NTIS CSCL 17B

All requirements for Deep Space Network capabilities needed to support Mariner Mars 1971 Mars orbital operations were compiled and reiterated with the implementing organizations. Trade-offs between schedule and capability were made in some instances. The resulting planned configuration by network system is described. Author

N71-34125*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VIKING MISSION SUPPORT
D. J. Mudgway *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 40-46 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17B

Attention is focused on Viking-related activity, as the DSN interface organization progresses from the planning through operational phases of the Viking missions. The question of DSN support for Viking navigation and progress since the latter part of 1970 is reviewed. Author

N71-34126*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
RADIO SCIENCE SUPPORT
K. W. Linries *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 47-48 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17B

Very long baseline interferometry techniques were used for high resolution studies of quasars. Wide band recording terminals were supplied to all stations; timing synchronization between stations was achieved by flying a rubidium frequency standard from the U.S. to Copenhagen and Leningrad. Results of other radio science experiments are briefly reviewed. J.A.M.

N71-34127*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF DIFFERENCED TRACKING DATA TYPES TO THE ZERO DECLINATION AND PROCESS NOISE PROBLEMS
K. H. Rourke and V. J. Ondrasik *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 49-60 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17B

This analysis, based upon a 3 parameter model of the range and range-rate observables, shows that in certain circumstances the differenced data types can be expected to improve the accuracy of the orbit determination solution. Some hardware and calibration requirements which will insure that the data will be of sufficient quality are briefly discussed. Author

N71-34128*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ANALYTICAL STUDY OF THE ADVANTAGES WHICH DIFFERENCED TRACKING DATA MAY OFFER FOR AMELIORATING THE EFFECTS OF UNKNOWN SPACECRAFT ACCELERATIONS
V. J. Ondrasik and K. H. Rourke *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 61-70 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17B

Using the six parameter representation of the range-rate observable, arguments are presented to show why differenced data may more effectively diminish the effects of unmodelable spacecraft accelerations than the conventional tracking data. For a Viking spacecraft experiencing unknown constant accelerations, the orbit determination solution using differenced data may be two orders of magnitude better than the solution obtained from conventional tracking data. Author

N71-34129*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXAMINATION OF THE EFFECTS OF STATION LONGITUDE ERRORS ON DOPPLER PLUS RANGE AND DOPPLER ONLY ORBIT DETERMINATION SOLUTIONS WITH AN EMPHASIS ON A VIKING MISSION TRAJECTORY c21
V. J. Ondrasik and N. A. Mottinger *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 71-77 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17G

For fairly short data arcs, a station longitude error was shown to produce an error in the spacecraft's right ascension. To minimize the effects of acceleration errors, compensating errors were made in the range for Doppler only solutions. Viking accuracy analysis results are also presented in tabular form. Author

N71-34130*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL PERIOD DETECTOR OSCILLOSCOPE TRIGGER c14
W. A. Lushbaugh *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 78-83 ref (See N71-34118 21-07)
Avail: NTIS

The equipment accepts a periodic digital sequence and associated clock, and outputs a single pulse once per period. This output is intended to be used as the external trigger for an oscilloscope. A digital readout of the numerical value of the period is also provided to enable determination of the correct trigger to be used for a multitrace display. Author

N71-34131*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GENERATION OF THE FORD SEQUENCE OF LENGTH 2 TO THE nth POWER, n LARGE c19
H. Fredricksen *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 84-85 refs (See N71-34118 21-07)
Avail: NTIS CSCL 12A

Three algorithms for forming the Ford sequence of length 2 to the nth power and compares the storage requirements for each of the three are presented. These sequences are used in checkout of digital communications equipment. Author

N71-34132*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WEIGHTS IN THE THIRD-ORDER REED-MULLER CODES c19

H. van Tilborg *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 86-94 refs (See N71-34118 21-07)
Avail: NTIS

In order to obtain performance superior to that of the (32,6) first-order Reed-Muller Code used on Mariner Mars 1969 and 1971 spacecraft, bandwidth limitations make it necessary to consider Reed-Muller codes of higher orders. The weights which can actually occur in the third-order Reed-Muller codes of lengths 256 and 512 are investigated. For length 256, the exact set of integers which occur as weights is found. Author

N71-34133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DETECTION OF FAILURE RATE INCREASES c15
G. Lorden (Calif. Inst. of Tech.) and I. Eisenberger *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 95-100 refs (See N71-34118 21-07)
Avail: NTIS CSCL 14D

The problem of devising systematic policies for replacement of worn-out equipment involves the detection of increases in failure rates. Detection procedures are defined as stopping times N with respect to the observed sequence of random failures. The concepts of quickness of detection and frequency of false reactions are made precise, and a class of procedures is studied which optimizes the former asymptotically as the latter is reduced to zero. Results of Monte Carlo experiments are given which show that efficient quickness of detection is attainable simultaneously for various levels of increase in failure rates. Author

N71-34134*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON THE BLIZARD DECODING ALGORITHM c19
L. R. Welch (Univ. of Southern Calif.) *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 101-104 refs (See N71-34118 21-07)
Avail: NTIS CSCL 12A

A method using an algorithm for decoding binary linear error correcting codes is summarized. The computational complexity of these algorithms within range of practicability is examined, including implementation of the maximum likelihood estimate. J.A.M.

N71-34135*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPROVED RF CALIBRATION TECHNIQUES: SYSTEM OPERATING NOISE TEMPERATURE CALIBRATIONS c14
M. S. Reid *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 105-109 ref (See N71-34118 21-07)
Avail: NTIS CSCL 14B

The system operating noise temperatures of the S-band research operational cone at DSS 13 (Venus Deep Space Station) and the polarization diversity S-band cone at DSS 14(Mars DSS) are reported for the period February 1 through May 31, 1971. Author

N71-34136*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSN RESEARCH AND TECHNOLOGY SUPPORT
E. B. Jackson *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 110-111 ref (See N71-34118 21-07)
Avail: NTIS CSCL 17B

Major activities of the development support group at both DSS 13 (Venus Deep Space Station) and the Microwave Test Facility are presented, and accomplishments and progress for each are described. Activities include radiometric observations (20-25 GHz), pulsar observations and planetary radar, precision antenna gain measurement (RASCAL), weak source observations, 100-kW operational clock synchronization transmitter implementation, clock synchronization transmissions, and DSIF klystron testing. Author

N71-34137*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
S-BAND PLANETARY RADAR RECEIVER DEVELOPMENT
C. F. Foster *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 112-113 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17I

The design modification of the DSS 14 bistatic radar receiver is described. This receiver is basically an open-loop superheterodyne receiver used for development of communication techniques. The modifications include wider bandwidths to support high-speed, high-resolution planetary mapping, and the redistribution of system gain to prevent noise saturation. The redesigned bistatic radar receiver was installed at DSS 14 and is now being used in the Venus radar mapping experiment. Author

N71-34138*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SFOF DIGITAL TELEVISION DISPLAY SUBASSEMBLY
F. L. Singleton *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 116-122 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17B

The television display accepts input digital data from the computer subassembly, converts it to video data, stores it, and provides a continuous television-compatible video output which is distributed throughout the SFOF. The display subassembly consists of a system control unit, four display generator units, and various hardcopy generation equipment. Author

N71-34139*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SFOF DIGITAL TELEVISION HARDCOPY EQUIPMENT
F. L. Singleton and K. Kawano *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 123-128 ref (See N71-34118 21-07)
Avail: NTIS CSCL 17B

The Space Flight Operations Facility digital television display subassembly has a hardcopy generation capability in addition to its display generation capability which is discussed. The display subassembly hardcopy equipment consists of a system control unit, twelve copy request units, a display image buffer, and twelve hardcopy printers. The hardcopy equipment can make a print of any digital television display channel upon request. Author

N71-34140*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARK 3A SIMULATION CENTER DIAGNOSTIC SOFTWARE c08
C. F. Leahey *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 129-132 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

The expansion and reconfiguration of the Deep Space Network simulation center to the Mark 3A configuration necessitated the modification of existing diagnostic software and the development of new diagnostic and test programs. The characteristics of the diagnostics which were developed for the EMR 6050-Univac 1108 interface and the interactive alphanumeric television display system are described. Author

N71-34141*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GCF HIGH-SPEED DATA SYSTEM DESIGN AND IMPLEMENTATION FOR 1971 - 1972 c08
R. H. Evans *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 133-137 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

The Deep Space Network Ground Communications Facility high-speed data system capabilities were significantly upgraded to meet the 1971-1972 era requirements. In general, those requirements doubled the data transmission rate to 4800 bps, added block demultiplexing at the remote stations, provided for block synchronous outbound transmission from the SFOF, and

provided positive labeling of error-free blocks. The major design problems encountered in implementing these requirements are discussed. Author

N71-34142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GCF DSS COMMUNICATIONS EQUIPMENT SUBSYSTEM HIGH-SPEED DATA ASSEMBLY c08
E. L. Yinger *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 138-143 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

The functional operation of the Ground Communications Facility (GCF)-developed and supplied high-speed data assembly now in use at each Deep Space Station (DSS), except DSS 13 (Venus DSS), and CTA 21 is described. The subassemblies are discussed, including those developed and incorporated during the latest reconfiguration, to fulfill the GCF high-speed system requirements for the 1971-1972 period. The assembly is used to convert all high-speed data leaving the DSS to a form suitable for transmission to the Space Flight Operations Facility and converts all high-speed data entering the DSS to a form suitable for use by the on-station computers. Author

N71-34143*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GCF SFOF COMMUNICATIONS TERMINAL SUBSYSTEM HIGH-SPEED DATA ASSEMBLY c08
G. J. Brunder *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 144-150 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

Improved capabilities and equipment were incorporated into the Space Flight Operations Facility communications terminal subsystem high-speed data assembly as a result of the 1970-1971 upgrade in support of the Deep Space Network. The distinct capabilities of the high-speed data assembly are discussed, and the new 4800-bps high-speed data circuits and equipment are described on a functional level. Author

N71-34144*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GCF AREA COMMUNICATIONS TERMINAL SUBSYSTEM HIGH-SPEED DATA REGENERATION ASSEMBLY c08
C. R. Rothrock *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 151-153 (See N71-34118 21-07)
Avail: NTIS CSCL 09B

The incorporation of a high-speed data regeneration assembly at the area communications terminal located at the Goldstone Deep Space Communications Complex has provided the necessary interface for high-speed data entering or leaving the complex. The physical as well as electrical characteristics are described. Author

N71-34145*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH-SPEED DATA SYSTEM PERFORMANCE AND ERROR STATISTICS AT 4800 bps c08
D. Nightingale *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 154-159 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

A survey was conducted from March through June of 1971 to study the performance of the Ground Communications Facility upgraded high-speed data system. Operational and other user traffic was used as the basis for the tabulated results. The conditions are described under which the data were gathered, and some conclusions are drawn based upon analysis of those data. Author

N71-34146*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTIPLE-MISSION TELEMETRY
W. Frey, R. Petrie, A. Lai, and R. Greenberg *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 160-164 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17B

A status update of the Deep Space Instrumentation Facility (DSIF) multiple-mission telemetry (MMT) is presented. Block diagrams depicting the various DSIF station MMT configurations and telemetry processing equipment added to support the Mariner Mars 1971 flight project are also included. Author

N71-34147*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTIPLE-MISSION COMMAND SYSTEM
J. Wilcher and J. Woo *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 165-166 ref (See N71-34118 21-07)
Avail: NTIS CSCL 17B

The multiple-mission command system (MMCS) project was establish in January 1969 to design, test, and install throughout the Deep Space Network (DSN) a command system capable of supporting all foreseeable spacecraft. All DSN stations considered prime for the MM '71 (Mariner Mars 1971) mission were implemented with the dual MMCS capability, including the PN sync units. The DSN stations considered as backup stations for MM'71 were implemented with dual MMCSs; however, only one PN sync unit per station was provided. Author

N71-34148*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTER-CONTROLLABLE PHASE SHIFTER c09
R. C. Coffin *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 167-169 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

A voltage-variable phase shifter having a linear voltage-to-phase characteristic was built and tested. The design uses a phase detector in a feedback loop configuration to linearize an RC phase shifter. The phase-shift characteristic is 72 degrees/volt operable over the range of 0 to 5 volts. Linearity is within + of - 1.5%. The design technique can be applied over frequencies extending from the audio range up to greater than 100 MHz. Author

N71-34149*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA DECODER ASSEMBLY c08
C. R. Greuling *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 170-177 ref (See N71-34118 21-07)
Avail: NTIS CSCL 09B

Future deep space missions (e.g., Pioneer F/G) will be using convolutional coding. The configuration of the Deep Space Network (DSN) is found not suited to perform the decoding of this class of codes. This function (amongst others) will be performed by the data decoder assembly which is scheduled for installation in the DSN in September 1971. The data decoder assembly and its implementation are described. Author

N71-34150*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPERATION OF THE DSN COMMAND SYSTEM FROM THE SPACE FLIGHT OPERATIONS FACILITY
W. G. Stinnet *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 178-180 (See N71-34118 21-07)
Avail: NTIS CSCL 17B

The operation of the Deep Space Network (DSN) command system from the Space Flight Operations Facility as configured for support of the Mariner Mars 71 mission is described. Functional capabilities, along with the use of these capabilities by DSN and flight project personnel, are also given. Author

N71-34151*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DOPPLER TRACKING SYSTEM MATHEMATICAL MODEL
C. W. Bergman *In its* The Deep Space Network, Vol. 4

15 Aug. 1971 p 181-187 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17I

The mathematical model that can be used to calculate the expected Deep Space Instrumentation Facility Doppler tracking system phase noise is given. The rms phase noise is due to the receiver input noise and is a function of the received signal strength. The strong signal phase noise is characteristic of station configuration and for practical purpose is independent of signal strength. The value of strong signal phase noise is determined experimentally. The test results confirm the validity of the model. Author

N71-34152*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
NUMERICAL EVALUATION OF THE TRANSIENT RESPONSE FOR A THIRD-ORDER PHASE-LOCKED SYSTEM
A. C. Johnson *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 188-199 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17B

A third-order phase-locked receiver is investigated for possible use in tracking high Doppler rates. Data pertaining to the transient analysis of a model of a third-order phase locked receiver is presented. The instantaneous response of the system is calculated for an input phase function. The results are compared with those of the usual second-order loop. Author

N71-34153*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSIF OPERATIONS SUPPORT OF MARINER MARS 1971
D. W. Johnston *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 200-204 (See N71-34118 21-07)
Avail: NTIS CSCL 17B

The DSIF operations activities in preparation for, up to, and including, Mariner Mars 1971 launches H and I are described. The DSIF hardware is covered briefly, with more coverage of the DSIF training, testing, operational documentation and performance aspects of the preparations. Author

N71-34154*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DSIF MARINER MARS 1971 TCP OPERATIONAL PROGRAM
R. L. Chafin *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 205-212 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17B

The Deep Space Instrumentation Facility Mariner Mars 1971 telemetry and command processing operational program provides the software necessary to support the Mariner Mars 1971 mission operation by processing all telemetry data from the spacecraft and providing a means to command the spacecraft from both the Space Flight Operations Facility and the station. The program is designed for use with the multiple-mission telemetry and multiple-mission command hardware. The organization, operation, and capabilities of this program are described. Author

N71-34155*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.
STUDY OF RECTANGULAR-GUIDE-LIKE STRUCTURES FOR MILLIMETER WAVE TRANSMISSION Final Report
Frederick J. Tischer 20 Jun. 1971 48 p refs
(Grant NGL-34-002-047)
(NASA-CR-121763) Avail: NTIS CSCL 20N

Essentials of the field distribution, characteristics, and applications of the fence are described. The concept permits design of integrated circuitry on a single dielectric slab. A study of terminating a fence guide in a reflectionless way was made. Measurements were conducted using Eccosorb foam dielectric materials in matched fence guide terminations with varying material thickness and lengths. Voltage standing wave ratios of less than 1.1 were obtained with linearly tapered terminations. An experimental investigation of a non-confocal resonator with cylindrical reflectors using two different types of coupling energy is also reported. Measurements were made of the field distribution, mode numbers, and the quality factor for varying separation of the reflector walls at three different frequencies. The dependence of the q-value on the mode numbers is discussed. Author

N71-34156*# Philco-Ford Corp., Palo Alto, Calif. Western Development Labs. Div.
STUDY OF EFFICIENT TRANSMISSION AND RECEPTION OF IMAGE-TYPE DATA USING MILLIMETER WAVES
C. Louis Cuccia 15 Jun. 1970 542 p refs
(Contract NAS12-2186)
(NASA-CR-121755; TR-DA2180) Avail: NTIS CSCL 20N

The evaluation of suitable signal processing and modulation techniques associated with the transmission and reception of image type data by millimeter wave relay satellites is discussed. Subjects discussed are: (1) types of sensors capable of frequency components up to 40-60 GHz, (2) types of analog to digital conversion techniques with bit rates of 40 to 4000 Mbps, (3) optimum types of modulation, (4) types of modulator and demodulator techniques for handling high bit rates (5) frequency ranges for supporting high data rate digital transmission, and (6) antenna and receivers to provide millimeter wave links. P.N.F.

N71-34157*# Texas Univ., Austin. Electrical Engineering Research Lab.
THE EVALUATION OF REFLECTOR ANTENNAS
John H. Davis 31 May 1970 200 p refs
(Grant NGL-44-012-006)
(NASA-CR-121752; TR-NGL-006-70-1) Avail: NTIS CSCL 09E

The evaluation of large reflector antennas is reported. The major findings include defining the effects of primary reflector astigmatism and its quantitative measurement through diffraction pattern measurements. A method is also presented which reveals the frequency dependence of antenna efficiency. Several basic problems are addressed. One is the focusing of reflector antennas and the interpretation of reflector errors from the antenna pattern. The effects of primary reflector astigmatism are investigated. Evidence is presented that several of the largest reflector antennas have astigmatism in their primary reflector. A method with which the antenna efficiency at one frequency can be inferred from the measured antenna efficiency at another frequency is proposed. The method given is much less restrictive than the Ruze method and bounds the effects of measurement errors. Author

N71-34158# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
ANALYSIS OF TRANSMISSION ELECTRON DIFFRACTION PATTERNS BY COMPUTER
R. A. Ploc and G. H. Keech Jan. 1971 42 p refs
(AECL-3729) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $1.50

A description of the mathematics and construction of the pattern computer program is given. The program geometrically treats transmission electron diffraction for any definable sample/photographic plate orientation. Intersection points of the diffracted beams with the photographic plate are printed, plotted, and indexed (Miller indices). Deviations from the Bragg condition are listed. Author

N71-34159*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MULTICHANNEL TELEMETRY SYSTEM Patent Application
Stanley Butman, inventor (to NASA) and Uzi Timor, inventor (to NASA) Filed 17 Mar. 1971 26 p
(Contract NAS7-100)
(NASA-Case-NPO-11572; US-Patent-Appl-SN-125234) Avail: NTIS CSCL 17B

A two-channel telemetry system is described in which one

channel is used for high-rate data and the other channel for low-rate data communication. In the transmitter a signal, which subsequently phase modulates a carrier, is produced which is a function of at least the high-rate data, the low-rate data, and the frequency of the subcarrier of the low-rate channel. In the receiver which includes a phase-locked loop, the high-rate data is detected off the receiver inphase channel output and the low-rate off the quadrature channel output. NASA

N71-34160*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
FLEXIBLE COMPUTER ACCESSED TELEMETRY Patent Application
Richard A. Easton, inventor (to NASA) and Edward E. Hilbert, inventor (to NASA) Filed 19 Feb. 1971 45 p
(Contract NAS7-100)
(NASA-Case-NPO-11358; US-Patent-Appl-SN-116786) Avail: NTIS CSCL 17B

Flexible, computer-accessed telemetry is provided by a sequence control unit, auxiliary memory, and system control registers. These permit sensors and digital data sources to be sampled in a programmed format with various groups of samples taken at different rates. Each programmed sample may be processed for transmission in a specified way by including an operation code with the programmed address code used to select the designated sensor or digital data source. Index registers and a scratch pad memory permit flexibility in programming sample sequencing formats. A particular format may be started, stopped, and altered by ground station commands received through a receiver, or directly by a digital computer. NASA

N71-34161*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TWO CARRIER COMMUNICATION SYSTEM WITH SINGLE TRANSMITTER Patent Application
Mahlon F. Easterling, inventor (to NASA) Filed 9 Jun. 1971 p
(Contract NAS7-100)
(NASA-Case-NPO-11548; US-Patent-Appl-SN-151411) Avail: NTIS CSCL 17B

A pulse-code modulated communication system is disclosed for transmitting two subcarrier modulated carriers from a single transmitter comprising two channels for phase modulating the two carriers independently. The modulating subcarriers are independently modulated by data and/or pseudonoise (PN) codes as desired. The modulated carriers are switched alternately to the single transmitter in synchronism with operation of a PN code generator when PN code modulation is present, as for ranging. NASA

N71-34162*# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrical Engineering.
CONSTRAINED ADAPTIVE DIGITAL ARRAY PROCESSING
Leonard P. Winkler and Mischa Schwartz May 1971 174 p refs
(Grant NGR-33-008-040)
(NASA-CR-121292; PIBEE-71-007) Avail: NTIS CSCL 09E

The optimal design of a detector array and signal processor to maximize the output signal to noise ratio subject to a constraint on the super gain ratio (Q factor) is discussed. An iterative gradient projection technique to achieve this design even when the noise statistics are unknown is described. Mathematical models of the significant relationships are presented. Author

N71-34163# Sandia Labs., Albuquerque, N. Mex.
INTERACTIVE MONITOR FOR A TELEMETRY PLAYBACK SYSTEM
W. C. Fienning Apr. 1971 78 p refs
(SC-DR-710211) Avail: NTIS

The philosophy and implementation of a monitor for a telemetry playback system are described. The system interacts with the operator to process pulse code modulation and analog tapes which have been digitized. Author

N71-34164*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A DIGITALLY CONTROLLED VERY HIGH FREQUENCY SYNTHESIZER
Joan H. Middleton Washington Sep. 1971 20 p refs
(NASA-TN-D-6389; L-7678) Avail: NTIS CSCL 09E

A digitally controlled frequency synthesizer, which can replace the multicrystal local oscillator in a general aviation navigation receiver, is described. The development of this synthesizer resulted from an effort to find less expensive and more reliable methods for generating local oscillator frequencies than is currently available by using the multicrystal technique. The synthesizer employs a phase-locked loop in which the output of a voltage-controlled oscillator is digitally divided and phase locked to a stable reference frequency. A new technique is used to accomplish the dividing. Because it is digital, the synthesizer lends itself readily to computer control. A breadboard model of the synthesizer is described. Author

N71-34165# Naval Fleet Material Support Office. Mechanicsburg, Pa.
BIBLIOGRAPHY OF DATA COMPRESSION AND DATA COMPACTION LITERATURE WITH ABSTRACTS Bibliography Report, 1952 - 1970
James J. Villers and Stephen R. Ruth 1 Feb. 1971 85 p refs
(AD-723525) Avail: NTIS CSCL 09/4

The document contains a comprehensive bibliographic research of the literature concerning the subjects of data compression, data compaction, data reduction in communications, telemetry, and data processing applications. Each reference is briefly abstracted. Author (GRA)

N71-34166# RAND Corp., Santa Monica, Calif.
A COST ANALYSIS OF MINIMUM DISTANCE TV NETWORKING FOR BROADCASTING MEDICAL INFORMATION
J. A. Dei Rossi, R. S. Heiser, and N. S. King Feb. 1970 83 p refs Sponsored by NIH
(RM-6204-NLM) Avail: NTIS

The problem of estimating the cost of networking the TV broadcasting of biomedical information, using common carrier land lines is discussed. Minimum distance networks for connecting the points in each network were calculated. The algorithm for these calculations was programmed for computers and provides the basic framework for the cost estimates. Two major networking applications were considered: the networking on a national basis of existing educational television stations and the networking, also on a national basis, of accredited medical schools. The first provides the cost of one-time (occasional) broadcasts aimed primarily at the biomedical community. The second provides the networking cost of a national closed circuit TV network for the nation's medical schools. Author

N71-34167# California Univ., Berkeley. Lawrence Radiation Lab.
PCM TELEMETRY SYSTEM FOR 3-MV SUPERHILAC INJECTOR
L. L. Reginato, N. J. Dobeck, and B. H. Smith Feb. 1971 2 p refs Presented at the Natl. Particle Accelerator Conf., Chicago, 1-3 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20179; Conf-710308-21) Avail: NTIS

A time-division multiplex communications system using pulse code modulation (PCM) was built for the new 3-MV Super-Hilac injector. Transmission between the high-voltage terminal and ground uses light beams generated by light-emitting diodes and is received by photodiodes. With each accelerator

pulse a sequence of 384 time slots is transmitted-each defined by a clock pulse transmitted over an adjacent light beam. Binary information is then conveyed by the presence or absence of pulses in the appropriate time slots. This system can handle, in either direction, 16 parallel analog input channels which are encoded into 16 12-bit binary coded decimal (BCD) serial words and 192 parallel ON-OFF input channels which are also encoded into 16 12-bit serial words. Thus a serial transmission in either direction consists of 32 12-bit words. Author (NSA)

N71-34168# Technische Hochschule, Darmstadt (West Germany).
AN EXPANSION OF QUASI-STATIONARY HOLLOW WAVEGUIDE EQUIVALENT-CIRCUIT DIAGRAMS TO RIDGE WAVEGUIDES AND THEIR APPLICATION IN PARAMETRIC SCATTERING OF THE H SUB 10 WAVEFIELD [EINE ERWEITERUNG DER QUASISTATION-AEREN HOHLLEITER-ERSATZSCHALTBILDER AUF STEGHOHLLEITER UND IHRE ANWENDUNG BEI DER PARAMETRISCHEN STEUERUNG DES H SUB 10-WELLENFELDS]
Werner Lorek (Ph.D. Thesis) 2 Dec. 1971 135 p refs In GERMAN
Avail: NTIS

A theoretical solution for diode incorporation into a hollow waveguide is obtained by: (1) field image calculations with an appropriate field substitute using Maxwell theory; (2) calculation of diode effects by using energetic traveling wave and adaptation theories of Tischer; and (3) determination of diode flux with the help of quasi-stationary equivalent-circuit diagrams for hollow waveguides and cathodes. The last method is used to construct a varactor modulator for the H sub 10 wave. Transl. by G.G.

N71-34169 British Broadcasting Corp., Kingswood (England). Research Dept.
SATELLITE BROADCASTING: POSSIBLE ADVANTAGES OF USING DIGITAL MODULATION FOR TELEVISION
A. Brown 1971 9 p refs
(BBC-1971/25) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The broadcasting of television from satellites is discussed. Comparisons are made of the carrier-to-noise ratios and co-channel protection ratios required for digitally-coded modulation, with those required for frequency modulation. It is unlikely that a digital system will permit a significantly lower transmitter power than that required for a f.m. system. However, a 12-phase digital system may have an advantage of about 2 to 8 db from the point of view of co-channel interference. Author

N71-34170 North Carolina State Univ., Raleigh.
AN EVALUATION OF AIRCRAFT COLLISION-HAZARD WARNING RADAR TECHNIQUES IN THE TERMINAL AREA
Charles Leslie Britt, Jr. (Ph.D. Thesis) 1970 183 p
Avail: Univ. Microfilms Order No. 70-16960

A computer simulation approach is used to determine the performance of various idealized collision-warning radar systems under actual flight conditions. A data base consisting of twelve hours of radar traffic data from the Alanta, Ga., terminal was obtained in cooperation with the FAA and NASA, and is used to determine statistical data on the performance of the various systems. Probabilities of alarms, average alarm rates, and statistics on alarm durations are estimated for the systems considered. The results of the computer simulations indicate that the false alarm problem in the terminal area is much more severe than had been previously recognized. With simulated systems that have been proposed as providing sufficient warning times, excessive alarms would have occurred under the flight conditions represented by the data. The most promising systems investigated that appear applicable to both general and commercial aviation will provide a minimum warning time on the order of thirty seconds for a co-altitude treat under the flight constraints assumed. Dissert. Abstr.

N71-35043*# McDonnell-Douglas Co., St. Louis, Mo.
A SOLUTION FOR THE SPACE SHUTTLE HIGH TEMPERATURE ANTENNA PROBLEM
E. A. Kuhlman *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 185-202 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35044*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANTENNA TECHNOLOGY: MATERIALS FOR ANTENNA PROTECTIVE COATINGS
M. C. Gilreath *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 203-222 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35045*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANTENNA TECHNOLOGY: ANTENNA DESIGN AND SCALE MODEL TECHNIQUES
W. F. Croswell *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 223-244 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35046*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AUTOMATIC ANTENNA SWITCHING TECHNIQUES
H. Dean Cubley *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 245-278 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35048*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LOW-RATE COMMUNICATIONS UTILIZING DIGITAL CODING AND MODULATION
B. H. Batson, C. K. Land, and R. W. Moorehad *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 291-310 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35049*# Martin Marietta Corp., Denver, Colo.
COMPRESSION AND ERROR CORRECTION FOR TV
R. B. Blizard, W. A. Stevens, J. L. Mc Kinney, H. M. Gates, W. B. Anthony et al *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 311-328 refs 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35050*# TRW Systems Group, Redondo Beach, Calif.
INTEGRATION OF RADIO FREQUENCY FUNCTIONS FOR NAVIGATION, VOICE AND DATA COMMUNICATION
T. S. Bettwy *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 329-362 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35051*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MICROWAVE TRAVELING WAVE TUBE AMPLIFIERS FOR SPACE COMMUNICATIONS SYSTEMS
Bruce M. Kendall *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 363-369 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N71-34171*# Maryland Univ., College Park. Computer Science Center.
EVALUATION OF AN ADAPTIVE APPROACH TO BUFFER STORAGE ALLOCATION
Serah Crooke and Jack Minker Jan. 1971 70 p refs
(Grant NGR-21-002-197)
(NASA-CR-119705; TR-147) Avail: NTIS CSCL 09B

An adaptive approach to the allocation and release of buffer storage within a system is investigated. Specifically, three techniques are evaluated. These are the buddy method, the first-fit method, and an adaptive method which uses the buddy system and the first-fit system depending on the user input statistics. The adaptive approach uses a predictor which determines when statistics change indicating when one should move from the buddy to the first-fit system and vice-versa. The approach to using the adaptive method was motivated by the fact that the buddy system was effective with respect to serving small buffer request sizes while the first-fit method was most was most effective for the allocation of large buffer storage. The investigation, therefore, considers the case when one is dealing with a system where the statistical characteristic of the buffer request sizes interchanges between small and large requests.
Author

N71-34172*# Maryland Univ., College Park.
SIMULATION OF A PAGING DRUM CHANNEL
Gee-yin Kwok May 1971 105 p refs
(Grant NGR-21-002-197)
(NASA-CR-121653; TR-155) Avail: NTIS CSCL 09B

The simulation of a paging drum channel system by ALGOL and SIMULA programs on the Univac 1108 in order to ascertain the paging algorithms is described. The paging drum channel system consists of five system units: paging drum, central processing unit, paging drum memory, main memory, and page table memory. The units are described by block diagrams and in computer design language statements. The algorithms for the paging sequences and the sequential operation of the system units are presented in flow charts.
Author

N71-34173*# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
CONTROL OPTIMIZATION, STABILIZATION AND COMPUTER ALGORITHMS FOR SPACE APPLICATIONS
Status Report, 1 Mar. 1970 - 1 Mar. 1971
May 1971 29 p refs
(Grant NGL-22-009-124; MIT Proj. DER-76265)
(NASA-CR-121630; Rept-9; rept-10; ESL-SR-446) Avail: NTIS CSCL 09B

The background, techniques and instrumentation used to investigate (1) estimation and control for uncertain systems, (2) stochastic stability with applications to the study of the human operator, (3) controllability of infinite dimensional systems, (4) deterministic compensator design, and (5) air traffic control, are reported.
E.H.W.

N71-34174*# Computer Sciences Corp., Huntsville, Ala. Field Service Div.
SUMS MULTIPROCESSOR CONFIGURATION CONTROL ANALYSIS AND SPECIFICATION
James R. Kennedy, Sr. 14 Jun. 1971 65 p refs
(Contract NAS8-18405)
(NASA-CR-119926) Avail: NTIS CSCL 09B

The problem of configuration control given a multiprocessor environment is analyzed. A key point in the analysis is the assumption that periodic changes in operational mode are desirable. Two modes of operation are considered: a democratic multiprocessor mode and a triple modular redundant (TMR) mode. A feasibility approach to switching requirements associated with mode changes is developed. In conjunction with the necessary mode switching requirements, instructions to perform the switching operations are specified, including a prose description of the effect of particular instructions on the switching devices, and various mode status indictors are defined and derived from the voting mechanism employed in the TME mode. The use of various indicators is discussed and an approach to separation of transient and hard system failures is suggested. In addition, the approach outlines a method for locking the system in a TMR mode in the event that failures are so prolific as to counter indicate a switch from the TMR mode back to the democratic multiprocessor mode. Conclusions are presented that estimate the switching time requirements based on the number of logic levels, and the number of gates necessary to perform the switching.
Author

N71-34175*# Maryland Univ., College Park. Computer Science Center.
ARCS AND CURVES IN DIGITAL PICTURES
Azriel Rosenfield Jul. 1971 20 p refs Sponsored in part by NASA
(Contract Nonr-5144(00))
(NASA-CR-121715; TR-162) Avail: NTIS CSCL 09B

Characterizations of digital simple arcs and simple closed curves are given. It is shown that the following are equivalent for sets S having more than 4 points: (1) S is a simple curve; (2) S is connected, and each point of S has exactly two neighbors in S; (3) S is connected, has exactly one hole, and has no deletable points. It was shown to follow that if a shrinking algorithm is applied to a connected S that has exactly one hole, it shrinks to a simple curve.
Author

N71-34176*# Wyoming Univ., Laramie. Natural Resources Research Inst.
GEOSECTION INDICES FOR ENVIRONMENTAL DATA
John C. Bellamy May 1971 38 p refs *Its* Inform. Circ. No. 65
(Grant NGR-51-001-001)
(NASA-CR-121661) Avail: NTIS CSCL 08E

A system of geosection index numbers is proposed for cross-indexing the many different kinds and growing amounts of environmental data. These index numbers basically identify those horizontal sections of the overall earth-centered geosphere to which any particular environmental data pertains. They thereby provide especially for identifying past and future observing stations on the surface of the earth; and hence for ordering indexes, tabulations and files of the environmental data from any and all such observing stations in a widely applicable and systematically interrelated way. These geosection subdivisions of the geosphere are also interchangeably representable with either the common alphanumeric or more pictographic forms of the numerals or indices that comprise such index numbers.
Author

N71-34177*# Harvard Univ., Cambridge, Mass.
ON THE STRUCTURE OF CONTEXT-SENSITIVE GRAMMARS
Ronald V. Book [1971] 11 p refs
(Grants NGR-22-007-176; NSF GJ-803)
(NASA-CR-121658) Avail: NTIS CSCL 09B

It is well known that the family of context sensitive grammars generates languages which are not context free and that it is undecidable whether a context sensitive grammar generates a context free language. The mechanism by which the use of context allows a noncontext free language to be generated is not well understood and in fact, the question of what context does for the user is vague. To clarify this question some basic definitions and facts about context sensitive grammars and languages are reviewed. Some of the constraints which can be placed on the form of the rules of context sensitive grammars without forcing the language generated to be only

context free are presented and the restrictions on the form of the rules of a context sensitive grammar which force the language generated to be context free are considered. Author

N71-34178*# Dynamics Research Corp., Wilmington, Mass.
LIFTING ROBOT-SPACE SHUTTLE PRELIMINARY MISSION PROFILE OPTIMIZATION PROGRAM. PART 2: PROGRAM LISTINGS
Robert G. Gottlieb 29 May 1971 215 p
(Contract NAS8-25713)
(NASA-CR-119923; R-120U-Pt-2) Avail: NTIS CSCL 09B

A listing for LIFTING ROBOT and a tabulation of the program routines with a brief description of each routine are presented. The subroutines occur in alphabetical order in both the listing and the table, with a few exceptions. Author

N71-34179*# Vanderbilt Univ., Nashville, Tenn.
STUDY OF NON-LINEAR OPTIMIZATION TECHNIQUES Research Report, May 1969 - Sep. 1970
E. Baylis Shanks 12 Jul. 1971 26 p refs
(Grant NGR-43-002-032)
(NASA-CR-121673) Avail: NTIS CSCL 09B

The status of nonlinear optimization technques in dynamic programming, especially algebraic, combinatorial, and enumerative methods in integer programming, was reviewed. A bibliography of the books and reports reviewed is presented. Results of research conducted in the area of solving ordinary, nonlinear differential equations, especially by Runge-Kutta type methods are also discussed. Progress made in optimizing such formulas that use nine, ten, or eleven evaluations is described. A.L

N71-34180*# Arizona Univ., Tucson. Engineering Experiment Station.
STOCHASTIC ALGORITHMS FOR SELF-ADAPTIVE FILTERING AND PREDICTION Semiannual Report
Robert Lee Thomas Hampton Jan. 1971 171 p refs
(Grant NGL-03-002-006)
(NASA-CR-121767) Avail: NTIS CSCL 09B

A study is reported aimed at the derivation of adaptive stochastic algorithms for learning directly the stationary discrete time optimal Kalman filter in an unknown random environment. To accomplish this derivation, an unsupervised learning criterion is formulated. It is shown that this criterion is a necessary and sufficient condition for optimal filtering. The criterion is then used in conjunction with the theory of stochastic approximation to develop the algorithms and to prove that they converge with probability one. In addition, a method for accelerating the adaptation rate is given. Techniques for estimating other useful quantities such as the error covariance are also presented. Finally, the stochastic algorithms are modified to accommodate slowly varying statistics and special classes of nonlinear systems. Numerical simulations are performed to verify experimentally the theoretical expectations and predictions for both linear and nonlinear systems. The adaptive technique is then applied to learning the optimal filter for a thermionic point reactor using the linearized prompt-jump approximation to the kinetics model of the reactor. Author

N71-34181*# Martin Marietta Corp., Denver, Colo.
OUTER PLANET DATA PRESENTATION COMPUTER PROGRAM, VOLUME 1 Model Description Report
Jul. 1971 207 p Prepared for JPL
(Contracts NAS7-100; JPL-953058)
(NASA-CR-121748; MCR-71-181-Vol-1) Avail: NTIS CSCL 09B

The program described was developed to provide visability into the acquisition of science data for alternate missions. More specifically, it was designed to provide the user with the capability to rapidly evaluate and manipulate mission variables, which include options on: instrument characteristics, instrument pointing and scan, spacecraft, data sample rate, flyby and orbiter trajectories, and natural satellites. The program is described in terms of summary, general overview, flow diagrams, symbol dictionary, operating procedures, and sample cases. Information concerning the program's purpose, application, flexibilities, and limitations is included. D.L.G.

N71-34182*# Martin Marietta Corp., Denver, Colo.
OUTER PLANET DATA PRESENTATION COMPUTER PROGRAM. VOLUME 2: APPENDIXES Model Description Report
Jul. 1971 178 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953058)
(NASA-CR-121747; MCR-71-181-Vol-2) Avail: NTIS CSCL 09B

Sample data cases are presented to aid initial input setup and program checkout. The samples consist of tabular and plotted data to confirm program operation by showing that numerous mission and experiment options have been used. In addition, a card listing of the Univac 1108 version of the subroutines is given, and a separate section provides supporting documentation. D.L.G.

N71-34183*# Maryland Univ., College Park. Computer Science Center.
KEY WORD IN CONTEXT INDEX AND BIBLIOGRAPHY ON COMPUTER SYSTEMS EVALUATION TECHNIQUES
Sarah Crooke, Jack Minker, and Jeffery Yeh Jan. 1971 66 p refs Supercedes TR 69-100
(Grant NGR-21-002-197)
(NASA-CR-121757; TR-146) Avail: NTIS CSCL 09B

This bibliography, in the form of a key word in context (KWIC) index, supercedes the bibliography (TR 69-100) on the same subject which was published in December 1969. The output from the KWIC index is reported in two parts: a sort on keywords in the document titles, and a bibliography sequenced according to a code word assigned to each title. The bibliography includes title, author(s), and citation. The documents selected contain information pertinent to the areas of system evaluation, simulation languages, mathematical modeling, and simulation techniques applicable to time-sharing, multiprocessing, and multiprogramming data processing systems. Author

N71-34184*# Intermetrics, Inc., Cambridge, Mass.
DEVELOPMENT OF AN MSC LANGUAGE AND COMPILER, VOLUME 1 Final Report
Jun. 1971 52 p refs
(Contract NAS9-10542)
(NASA-CR-115126; MSC-01848-Vol-1) Avail: NTIS CSCL 09B

The design and development are described of: (1) a higher order programming language as part of the manned spaceflight computer software for the 1972 to 1980 period, and (2) a compiler that accepts statements of the developed language and produces code that operates on the IBM 360/75 of the RTCC at MSC. In designing the advanced programming language emphasis was placed on reliability in terms of readability and data protection. By incorporating a full spectrum of data types, including bits and characters, the language finds utility for on-board software as well as for ground support, simulation, analysis, test and checkout, and compilers and assemblers. The compiler was designed to take advantage of automatic compiler generation techniques. As a key ingredient, the total grammar is expressed in a meta-language and changes are easily incorporated and thoroughly checked for ambiguities and inconsistencies by a grammar analysis program that automatically produces the syntax tables used by the compiler. D.L.G.

N71-34185*# Intermetrics, Inc., Cambridge, Mass.
A GUIDE TO THE HAL PROGRAMMING LANGUAGE, VOLUME 2 Final Report
Jun. 1971 180 p
(Contract NAS9-10542)
(NASA-CR-115127; MSC-01848-Vol-2) Avail: NTIS CSCL 09B

An introductory guide to HAL, a programming language developed for advanced manned spacecraft, is presented. The

basic characteristics of HAL are outlined followed by descriptions of the language elements, program structure, data, statements, input-output, and source code preparation. Separate sections deals with the general capabilities of the language and mathematical subset descriptions. D.L.G.

N71-34186*# Symbolic Control, Inc., Palo Alto, Calif.
APT COMPARATIVE STUDY
[1971] 36 p
(Contract NAS2-6313)
(NASA-CR-114360) Avail: NTIS CSCL 09B

A study of three APT processors on the IBM System 360 is summarized in this document. Systems analyzed included APT/70 (J40), NC/360 4M2, and APT 4 (4x3), provided by the APT Long-Range Program (ALRP). These systems are analyzed with respect to absolute and comparative reliability, processing efficiency (speed), cost (speed and hardware resources) and compatibility. The analysis was performed on an IBM System 360/67 at NASA/Ames Research Center under OS/360 (MFT). One hundred and fifty test and production parts, with a wide range of size and complexity, were processed against each of the APT systems. Statistical data gathered includes success rate (APT system failure), processing times, and costs. Significant differences in both processing efficiency, cost and reliability are identified and documented. Author

N71-34187*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
VERSATILE ARITHMETIC UNIT FOR HIGH SPEED SEQUENTIAL DECODER Patent Application
Warren A. Lushbaugh, inventor (to NASA) and James W. Layland, inventor (to NASA) Filed 22 Feb. 1971 20 p
(Contract NAS7-100)
(NASA-Case-NPO-11371; US-Patent-Appl-SN-117575) Avail: NTIS CSCL 09B

The development of an arithmetic unit for decoding data encoded by convolutional encoding is discussed. Block diagrams and circuit drawings of the equipment are presented. A distinct feature of the system is the connections between the two channels which enables the arithmetic unit to include only two channels. NASA

N71-34188*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL SCOPE THRESHOLD COMPRESSOR Patent Application
Tage O. Anderson, inventor (to NASA) Filed 13 May 1971 20 p
(Contract NAS7-100)
(NASA-Case-NPO-11830; US-Patent-Appl-SN-143078) Avail: NTIS CSCL 09B

Apparatus is discribed for data compression by a decreasing slope threshold test using digital techniques. The data stream through an input register is examined and only those samples of the raw data are selected for transmission which have a first difference (slope) exceeding and exponentially decaying threshold function relative to a bias. If a sample is transmitted, it becomes the new bias and a generator of the threshold function is reset. For threshold comparison, the bias is first subtracted from each first difference to produce a second difference for direct comparison of its absolute value with the absolute value of the threshold function, thereby allowing the function generator to run from a constant reference to generate a single sided exponentially decaying function. NASA

N71-34189*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AUTOMATED ATTENDANCE ACCOUNTING SYSTEM Patent Application
Carl P. Chapman, inventor (to NASA), Richard W. Anderson, inventor (to NASA), and William D. Hodgson, inventor (to NASA) Filed 16 Jun. 1971 33 p
(Contract NAS7-100)
(NASA-Case-NPO-11456; US-Patent-Appl-SN-153543) Avail: NTIS CSCL 09B

A system for enabling data to be applied to a centrally situated memory from many independently operable data terminals positioned at a number of different locations is described. The system is applied to collecting, consolidating, updating, and storing data concerning individual students and faculty members in an educational institution. Author

N71-34190*# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Electrical Engineering.
A STUDY OF DIGITAL TECHNIQUES FOR SIGNAL PROCESSING Final Status Report, 1 Aug. 1970 - 31 Jan. 1971
Mischa Schwartz and Robert R. Boorstyn 31 Jan. 1971 40 p
(Grant NGR-33-006-040)
(NASA-CR-121293) Avail: NTIS CSCL 09B

An analysis of digital techniques for signal processing is presented. Subjects discussed are: (1) adaptive maximum likelihood receiver for digital data transmission, (2) dynamic programming applied to adaptive equalizer design, (3) automatic equalization in the frequency domain, (4) recursive adaptive equalizers, and (5) finite memory communication system. Author

N71-34191# RAND Corp., Santa Monica, Calif.
THE IMPACT OF FUTURE DEVELOPMENTS IN COMPUTER TECHNOLOGY
William R. Graham Jun. 1970 16 p refs Presented at Joint Air Force and Lockheed Aircraft Conf. on Computer-Oriented Analysis of Shell Struct., 13 Aug. 1970
(P-4401) Avail: NTIS

The advantages and disadvantages of some radical computer designs are given. Switching speeds for magnetic cores, magnetic films, and transistors are shown respectively as 10 to the minus 7th power, 10 to the minus 9th power, and 10 to the minus 9th power. Changes in the organization of computers are discussed. Topics presented include: parallel computer, pipeline processor, parallel and pipeline, 64 bit precision parameters and computation speeds, and machine language for ILLIAC 4. F.O.S.

N71-34192# Joint Publications Research Service, Washington, D.C.
THE ROLE OF DEVICES IN KNOWLEDGE AND THEIR CLASSIFICATION
F. V. Lazarev et al 25 Aug. 1971 13 p Transl. into ENGLISH from Filosofskiye Nauki (USSR), no. 6, 1970 p 82-89
(JPRS-53910) Avail: NTIS

Some gnosiological functions and information properties of various types and classes of devices are examined. On the basis of the criteria derived in this manner, a corresponding classification for the devices is suggested. Author

N71-34193# RAND Corp., Santa Monica, Calif.
HOW TO STORE IT
B. L. Fox Mar. 1971 9 p refs
(P-4459-1) Avail: NTIS

Storage layout for branch-and-bound algorithms is discussed. A composite branching rule, alternating between backtracking and branching from the point corresponding to the minimum bound, is recommended as the best compromise between reducing storage and the number of iterations. Author

N71-34194 National Lending Library for Science and Technology, Boston Spa (England).
CRITICAL CONTROL OF METEOROLOGICAL INFORMATION USING A DIGITAL COMPUTER
L. I. Bryieva et al [1971] 6 p
(NLL-M-20718-(5828.4F)) Avail: Natl. Lending Library, Boston, Spa, Engl.: 1 NLL photocopy coupon

Two methods, Fourier series expansion and Lagrange polynomials, are used in the critical control analysis of meterological observations by computer. Data to be controlled include air temperature, absolute humidity, relative humidity, saturation deficit, and air pressure. Results indicate the Fourier series expansion is not a promising method for control of these elements. E.H.W.

N71-34195# Maryland Univ., College Park. Computer Science Center.
VISUAL TEXTURE ANALYSIS, 3
E. B. Trov, E. S. Deutsch, and A. Rosenfeld Feb. 1971 24 p
(Contract AT(40-1)-3662)
(TR-145) Avail: NTIS

A study of various techniques for extracting from gray value pictures is reported, including a method of extracting relatively noise-free objects from a noisy background. Results for both real and computer-generated pictures are shown. Author

N71-34196# Maryland Univ., College Park. Computer Science Center.
A GENERAL CONVERGENCE RESULT FOR UNCONSTRAINED MINIMIZATION METHODS
James N. Ortega and Werner C. Rheinboldt Feb. 1971 9 p refs
(Grant NSF GJ-1067)
(TR-150) Avail: NTIS

A general convergence theorem for iterative methods for unconstrained minimization problems is presented. The key point is the concept of an essentially gradient-related sequence which includes the previously studied gradient-related sequences, as well as sequences which arise from univariate relaxation methods. Author

N71-34197# RAND Corp., Santa Monica, Calif.
A SELECTIVE BIBLIOGRAPHY OF COMPUTER GRAPHICS
R. H. Anderson Apr. 1971 35 p
(P-4629) Avail: NTIS

A bibliography of computer graphic subjects is presented. Subjects are listed in the following categories: (1) graphics, general, (2) graphics applications, (3) computer aided design, (4) animation, (5) computer generated graphic art, (6) graphics languages and subroutine packages, (7) graphic text manipulation, programming, debugging, (8) data structures for computer graphics, and (9) projections and transformations. Author

N71-34198# RAND Corp., Santa Monica, Calif.
COMPUTER MEMORY MANAGEMENT AT RAND
A. C. Shetler and S. Glassman May 1971 104 p
(P-4585) Avail: NTIS

A nonsupported, release dependent, modification to the initiator which allows memory locations to be assigned to a particular initiator is described along with the current environment of the computation center. The memory management accomplished by fixed initiators, and the externals and internals of their implementation are presented. F.O.S.

N71-34199# Joint Publications Research Service, Washington, D.C.
COMPUTERS IN SHIPBUILDING
A. T. Mitsevich et al 25 Aug. 1971 140 p refs Transl. into ENGLISH of the book "Itogi Nauki i Techniki, Sudostroyeniye 1965-1967, Primeneniye Elektronnykh Vychislitelnykh Mashin v Sudostroyenii" Moscow, Acad. of Sci. USSR, 1969 p 1-134
(JPRS-53906) Avail: NTIS CSCL 09B

Information is presented concerning the application of electronic computers to scientific research in shipbuilding, involving computations in the process of ship design, and in the control of the technological process of ship construction. Special attention is given to solving problems of basic parameter selection in ship design through the use of computers. The various areas of computer application in the shipbuilding industry are treated individually and include computer usage for: (1) engineering computations and for processing and storing structural information, (2) technical-economic computations and the solution of extremal problems in shipbuilding, (3) automating sketch work and engineering processes in shipbuilding, and (4) perfecting methods of planning and control of ship design and construction processes. D.L.G.

N71-34200# Technische Hochschule, Darmstadt (West Germany).
SIGNAL ANALYSIS AND SYNTHESIS WITH WALSH FUNCTIONS [SIGNALANALYSE UND SYNTHESE MIT WALSH-FUNKTIONEN]
Claus Boesswetter (Ph.D. Thesis) 1970 43 p refs In GERMAN and ENGLISH
Avail: NTIS

A complete orthogonal set of Walsh functions is developed and used to describe time functions in the sequency domain of signals by series convergence in the least mean square fit. Signal analysis and synthesis are performed by expansion into a Walsh series sequency spectrum that depends on time, since the time window of all realizable sequency filters has a finite length. Author

N71-34201 National Lending Library for Science and Technology, Boston Spa (England).
METHOD FOR DRAWING ISOPLETHS FOR 2-DIMENSIONAL FIELDS USING A DIGITAL COMPUTER
K. E. Cernin [1971] 8 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauchn.-Issled. Inst. (Leningrad), no. 291, 1970 133-139
(NLL-M-20591-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A method is described for constructing points on isopleths which uses grid point values of the function and is based on biquadratic approximation in the separate parts of a domain. A program was written to realize the various algorithms developed. The results of processing a surface pressure field manually and using the program and a two coordinate drawing instrument were compared. Author

N71-34202 Washington Univ., St. Louis, Mo.
DESIGN OF A LEARNING MACHINE AND THE STUDY OF SOME OF ITS CONVERGENCE CHARACTERISTICS
Robert Gordon Bellaire (Ph.D. Thesis) 1970 145 p
Avail: Univ. Microfilms Order No. 70-18940

Whenever the dynamics and environment of a process are unknown or very complex, there is a need for learning machines capable of learning the optimal decision algorithm from experience. Such a learning machine is described. The basic learning situation is specified by a set of six postulates and the machine MAXINE is developed to learn in this situation. MAXINE is designed to have some of the qualities of human decision making: while being able to change its mind in the face of new evidence, it is reluctant to alter firmly held opinions. The learning ability of this machine is tested by placing it in situations of varying degrees of complexity, including those which are deterministic and stochastic. Convergence of the proposed learning algorithm for the deterministic case is proved. Dissert. Abstr.

N71-35053*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MODULAR SPACEBORNE PROCESSORS
W. R. Wadden (RCA, Camden, N. J.), H. S. Zieper (RCA, Camden, N. J.), J. M. Gould, and R. Asquith *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 3-28
Prepared jointly with RCA, Camden, N. J. Advanced Technol. Labs. (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35064*# General Electric Co., Utica, N.Y.
FAULT-TOLERANT COMPUTER DESIGN FOR SPACE SHUTTLE
Irving Goodman *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 27-46 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35065*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CONFIGURATION ALTERNATIVES FOR DATA BUS SUBSYSTEM INTERFACE UNITS
Edward Chevers and William Mallary *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 47-70 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35066*# General Electric Co., Daytona Beach, Fla.
DATA BUS CONCEPTS FOR THE SPACE SHUTTLE
John R. Lane *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 71-86 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35067*# TRW Systems, Redondo Beach, Calif.
DATA BUS TO SERVICED EQUIPMENT AND SENSOR INTERFACE
Berry S. Yolkan *In* NASA. Manned Spacecraft Center Proc. of the Space shuttle Integrated Electron. Conf., Vol. 3 1971 p 87-110 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35068*# Martin Marietta Corp., Denver, Colo.
SELF-SEQUENCING DATA BUS TECHNIQUES FOR SPACE SHUTTLE
Robert H. Hardin *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 111-140 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35069*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOFTWARE DEVELOPMENT AND VERIFICATION TECHNOLOGY
H. Trauboth and B. Hodges *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 141-178 ref (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35080*# TRW Systems, Redondo Beach, Calif.
SYNCHRONOUS EXECUTIVE AND BUS CONTROL SOFTWARE FOR REDUNDANT DATA MANAGEMENT SYSTEMS
T. E. Daly *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 179-190 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35081*# Intermetrics, Inc., Cambridge, Mass.
HAL, A COMPILER LANGUAGE FOR SHUTTLE
Fred H. Martin *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 191-220 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35083*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
ONBOARD DATA STORAGE FOR SPACECRAFT
J. E. Holthaus and L. B. Gangaware *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf, Vol. 3 1971 p 251-288 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35085*# TRW Systems Group, Redondo Beach, Calif.
SELF-TEST TECHNIQUES FOR REDUNDANT DATA MANAGEMENT SYSTEMS
Myron Kayton and H. S. E. Tsou *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 309-328 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-34140*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARK 3A SIMULATION CENTER DIAGNOSTIC SOFTWARE
C. F. Leahey *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 129-132 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

N71-34141*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GCF HIGH-SPEED DATA SYSTEM DESIGN AND IMPLEMENTATION FOR 1971 - 1972
R. H. Evans *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 133-137 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

N71-34142*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GCF DSS COMMUNICATIONS EQUIPMENT SUBSYSTEM HIGH-SPEED DATA ASSEMBLY
E. L. Yinger *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 138-143 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

N71-34143*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GCF SFOF COMMUNICATIONS TERMINAL SUBSYSTEM HIGH-SPEED DATA ASSEMBLY
G. J. Brunder *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 144-150 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

N71-34144*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GCF AREA COMMUNICATIONS TERMINAL SUBSYSTEM HIGH-SPEED DATA REGENERATION ASSEMBLY
C. R. Rothrock *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 151-153 (See N71-34118 21-07)
Avail: NTIS CSCL 09B

N71-34145*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
HIGH-SPEED DATA SYSTEM PERFORMANCE AND ERROR STATISTICS AT 4800 bps
D. Nightingale *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 154-159 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

N71-34146*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTER-CONTROLLABLE PHASE SHIFTER
R. C. Coffin *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 167-169 refs (See N71-34118 21-07)
Avail: NTIS CSCL 09B

N71-34149*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DATA DECODER ASSEMBLY
C. R. Grauling. *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 170-177 ref (See N71-34118 21-07)
Avail: NTIS CSCL 09B

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-34203*# Washington Technological Associates, Inc., Rockville, Md.
MOTOR DRIVERS FOR dc BRUSHLESS MOTORS Final Report
George L. Ward and David Nafus Jul. 1971 28 p
(Contract NAS5-21186)
(NASA-CR-121498; WTA-3319) Avail: NTIS CSCL 09C

The design, fabrication, and test of motor drivers for the three phase delta wound brushless dc motors are described. The motor functions by electronically directing current into the proper windings to eliminate the need for mechanical brushes. A series of lamps and photocells arranged in the motor provides commands to a motor driven package which then directs current into the proper motor windings. The driver package also contains a control amp to control the current level through the motor. The system, packaged in hybrid flatpacks, includes the control amp and driver circuits. E.H.W.

N71-34204*# Colorado State Univ., Fort Collins. Dept. of Electrical Engineering.
A THIN POLYMER INSULATOR FOR JOSEPHSON TUNNELING APPLICATIONS Semiannual Report
C. W. Wilmsen and J. C. Robertson Jul. 1971 33 p refs
(Grant NGR-06-002-094)
(NASA-CR-121732) Avail: NTIS CSCL 09A

Experience with Josephson junction formation is reported. It has become increasingly obvious that the chemisorption process must be fully understood before a complete monolayer can be successfully achieved. Therefore, the major emphasis is on the study of chemisorption and, in particular, the chemisorption of organics on the Pb surface. Three methods presently being used are carbon-14 labeled organics, differential volume experiments on Pb powders, and computer simulation. In addition, the effects of shorts and geometry on the electrical characteristics of Josephson junctions are analyzed. Author

N71-34205*# Honeywell, Inc., Lexington, Mass. Radiation Center.
MERCURY CADMIUM TELLURIDE PHOTODIODE Interim Report, May - Nov. 1970
D. A. Soderman and A. B. Timberlake Nov. 1970 72 p refs
(Contract NAS5-21197)
(NASA-CR-121786) Avail: NTIS CSCL 09A

High speed sensitive (Hg,Cd)Te photodiode detectors operating in the 77 to 90 K temperature range were developed for the 10.6 microns spectral region. The p-n junctions formed by impurity (gold) diffusion in n-type (Hg,Cd)Te and by stoichiometric deviation (mercury) diffusion in p-type (Hg,Cd)Te were investigated. These photodiodes of approximately 0.003 sq cm area have exhibited responsivities between 20 and 360 V/W, external quantum efficiencies between 2 and 50%, specific detectivities (11.5, 1 kHz, 1 Hz) between 0.7 and 1.7 x 10 to the 10th power cm Hz(1/2)W, and response times between 40 and less than 7 nanoseconds (25 MHz) which is the frequency limitation of the CO2 laser heterodyne system. Author

N71-34206# United Kingdom Atomic Energy Authority, Harwell (England).
IMPROVED ELECTRONIC ARRANGEMENT FOR BERYLLIUM MONITORS
A. T. Rolls Mar. 1971 14 p refs
(AERE-R-6308) Avail: AEC Depository Libraries; HMSO 23p; BIS $1.00

Microgram quantities of beryllium may be measured by utilizing a gamma-n reaction in beryllium, and counting the resulting neutrons in a ring of BF3 counters immersed in a neutron thermalizing medium such as polythene, borax, or paraffin wax. Hitherto most such monitors have employed BF3 counters connected in parallel and feeding a common amplifier/discriminator. An arrangement is described whereby each counter has its own amplifier/discriminator. The advantages of this arrangement are given with particular reference to the reduction of background arising from gamma-pulse pile-up, the enhanced immunity from environmental electrical interference and the easier identification, isolation or replacement of a faulty counter. Author (NSA)

N71-34207# Institute of Nuclear Research, Warsaw (Poland).
EMITTER FOLLOWER TEMPERATURE STABILITY AND LINEARITY ANALYSIS
R. Bayer 1970 30 p refs
(INR-1236) Avail: AEC Depository Libraries

The analysis is done with the help of signal flow graphs. The advantages of the method are more pronounced when the sensitivity, stability, gain, input and output impedances are considered. The transistor is replaced with its hybrid-pi model. The results of the analysis are given. Author (NSA)

N71-34208*# Hughes Aircraft Co., Los Angeles, Calif.
IMPROVED HIGH-VOLTAGE ISOLATOR FOR LIQUID METAL FEED LINES Patent Application
Julius Hyman, Jr., inventor (to NASA) Filed 22 Mar. 1971 20 p Prepared for JPL
(Contracts NAS7-100; JPL-952131)
(NASA-Case-NPO-11075; US-Patent-Appl-SN-126814) Avail: NTIS CSCL 09A

A cyclically operable high-voltage isolator is described which is particularly suited for use in introducing a series of charges of gas into a continuously flowing body of liquid metal for intermittently interrupting the electrical continuity of the body. An improved plenum chamber capable of operating at ambient temperatures is included for cyclically discharging slugs of bubble-forming hydrogen gas into an associated feed line as it conducts a flowing body of liquid metal to a high-voltage system. NASA

N71-34209*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MAGNETIC ARC STABILIZATION IN COMPACT ARC LAMPS Patent Application
Charles G. Miller, inventor (to NASA) Filed 11 Mar. 1971 18 p
(Contract NAS7-100)
(NASA-Case-NPO-10887; NASA-Case-NPO-11484; US-Patent-Appl-SN-123289) Avail: NTIS CSCL 09A

Stability is promoted in xenon compact arc lamps by providing longitudinal magnetic fields in the vicinity of the cathode tip. A magnetic ring or solenoid disposed external to the lamp envelope is utilized to control and stabilize the location of the arc discharge attachment at the cathode tip in sequentially fired multiple anode lamps and to neutralize stray magnetic fields produced by ferromagnetic supports for banks of lamps. NASA

N71-34210*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HIGH POWERED ARC ELECTRODES Patent Application
Jesse H. Hall, inventor (to NASA), Clarence C. Gottelman, inventor (to NASA), John L. Pollack, inventor (to NASA), Gary C.

Goldman, inventor (to NASA), and Arthur J. Decker, inventor (to NASA) Filed 14 May 1971 13 p
(NASA-Case-LEW-11162-1; US-Patent-Appl-SN-143508) Avail: NTIS CSCL 09E

Nonconsumable metal electric arc electrodes are described which are capable of being operated at various pressures, currents, and powers. The electrodes are designed for producing and arc which forms a radiation source for a solar simulator. The cathode has a circular annulus tip to spread the emission area for improved cooling. NASA

N71-34211*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ELECTRICAL CONNECTOR Patent Application
Wilhelm Angele, inventor (to NASA) and Hans G. Martineck, inventor (to NASA) Filed 21 Apr. 1971 19 p
(NASA-Case-MFS-20757; US-Patent-Appl-SN-136008) Avail: NTIS CSCL 09A

A separable flat cable connector is described having each pair of mating electrical contacts fully isolated from one another by means of insulating compartments extending rearwardly from the mating face of the plug half. The plug body is an integral, molded plastic member with two rows of compartments separated by a central wall. Two flat conductor cables, introduced through the rear of the plug, have exposed conductors extending forward along the central wall, with the conductor ends being secured in grooves defined by projections on the central compartment wall spaced back from the mating face. The receptacle half of the connector has an outer housing adapted to receive the plug body and forward-projecting spring contact elements with arcuate surfaces for engagement with the exposed conductors in the plug. Spring contact elements of the receptacle are disposed so that their rearwardly extending ends are slined in four spaced-apart rows to facilitate soldering of round wire conductors or flat conductor cables. NASA

N71-34212*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
CURRENT REGULATING VOLTAGE DIVIDER Patent Application
Howard B. Hester, inventor (to NASA) Filed 21 Apr. 1971 8 p
(NASA-Case-MFS-20935; US-Patent-Appl-SN-136007) Avail: NTIS CSCL 09E

A current regulating voltage divider is described which contains two input lines having a constant voltage difference and a center line for which it is desired to maintain a substantially constant voltage intermediate between the voltages of the input lines. Two transistors of the opposite conducting type are connected together so that each one shunts a corresponding load between the center line and an input line such that in the event of a load change, one of the transistors turns on to supply or pass the current necessary to maintain the center line voltage at its desired level. NASA

N71-34213*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMAL MOTOR Patent Application
Lloyd J. Derr, inventor (to NASA) and Robert A. Tobias, inventor (to NASA) Filed 24 Feb. 1971 21 p
(Contract NAS7-100)
(NASA-Case-NPO-11283; US-Patent-Appl-SN-118270) Avail: NTIS CSCL 09E

An electrically powered device consisting of a slotted bimetallic strip connected to a mechanical shaft is described. As electric currents or heat are applied to the bimetallic strip, the flexing caused by the unequal expansion of the two metals is converted into mechanical motion which can be used to operate a counter or similar device requiring limited motion in only one direction. P.N.F.

N71-34214*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COAXIAL INVERTED GEOMETRY TRANSISTOR HAVING BURIED EMITTER Patent Application
Ronald J. Hruby, inventor (to NASA), Steven B. Cress, inventor (to NASA) (Lockheed Missiles and Space Co.), and William R. Dunn, inventor (to NASA) (Lockheed Missiles and Space Co.) Filed 9 Jun. 1971 20 p
(NASA-Case-ARC-10330-1; US-Patent-Appl-SN-151412) Avail: NTIS CSCL 09A

An inverted geometry transistor where the emitter is buried within the substrate is described. The transistor can be fabricated as a part of a monolithic integrated circuit and is particularly suited for use in applications where it is desired to employ actuating voltages. The transistor may employ the same doping levels in the collector and emitter, so these connections can be reversed. NASA

N71-34215*# Wilorco, Inc., Long Beach, Calif.
INVERTER Patent Application
Kurt Willner, inventor (to NASA) and William T. Mc Lyman, inventor (to NASA) Filed 29 Mar. 1971 16 p Prepared for JPL
(Contract NAS7-100; JPL-952003)
(NASA-Case-NPO-10760; US-Patent-Appl-SN-129071) Avail: NTIS CSCL 10A

A description is given of an oscillator that is used in an inverter over a wide range of load. The oscillator has two transistors connected in a push-pull amplifier configuration. The amplifier utilizes current feedback through primary windings of a saturable transformer connected in series with an output transformer between collectors of the transistors. Voltage feedback is provided through a third primary winding of the saturable transformer connected in series with a resistor between the collector of one transistor and a center tap in the primary winding of the output transformer. NASA

N71-34216# Outokumpu Oy, Tapiola (Finland).
ON THE CALCULATION OF SELECTED PROBLEMS OF ELECTROMAGNETIC INDUCTION
Sven-Erik Hjelt (Ph.D. Thesis - Helsinki Univ. of Tech. Finland) 1970 15 p refs
Avail: NTIS

Three techniques for solving Maxwell equations in electromagnetic problems are outlined. The calculation of induced current densities applied to induction heating and the calculation of secondary fields of conducting bodies applied to electromagnetic prospecting are presented and discussed. J.M.

N71-34217# Owens-Illinois, Inc., Toledo, Ohio.
THREE COLOR PLASMA PANEL DISPLAY DEVICE
Quarterly Report, 1 Oct. - 31 Dec. 1970
F. H. Brown, W. D. Petty, C. W. Salisbury, and M. Tamm Zaysc Apr. 1971 41 p
(Contract DAAB07-70-C-0243; ARPA Order 1582)
(AD-723985; Ecom-0243-2; QR-2) Avail: NTIS CSCL 09/5

The objectives of this program are to design, fabricate, and evaluate a plasma-panel display device having a three-color capability and to investigate and develop a technique for operating such a device with at least three levels of intensity. Good electrode-phosphor alignment has been achieved in 33 1/3 line-per-inch devices by using taut-line printed electrodes in combination with silk-screen printed connector pads. The mechanism of phosphor attachment was investigated using various thermal analyses of the photoresist and dielectric layers. New art-work was designed and ordered in preparation for making 60 lpi panels. Work on improving panel sealing and registration was continued. Three-intensity-level address capability under computer control was demonstrated for a monochrome DIGIVUE display panel. A manually controlled test system was designed and built to determine the multi-state operating characteristics of color panels. Author (GRA)

N71-34218# Toulouse Univ. (France).
CONTRIBUTION TO THE SYNTHESES OF SEQUENTIAL LOGICAL MACHINES WITH THE HELP OF THRESHOLD

ELEMENTS [CONTRIBUTION A LA SYNTHESE DES MACHINES LOGIQUES SEQUENTIELLES A L'AIDE D'ELEMENTS A SEUIL]
Jean-Claude Geffroy (Ph.D. Thesis) 11 Mar. 1971 175 p refs In FRENCH
(N-1066) Avail: NTIS

The fundamental criteria for the synthesis of sequential threshold machines are the logical capacity parameters of their threshold elements: logical sequential circuit functions as defined by flow charts, and the equality of transition times between internal units and module response. A computer program is developed for determining those internal units where each secondary variable and each output variable are threshold elements. The realization of an ordinary asynchronous Moor machine is described. Transl. by G.G.

N71-34219# Sandia Corp., Albuquerque, N. Mex.
SOLID-STATE PULSER CONSIDERATIONS FOR LSA AND TRAPATT MICROWAVE OSCILLATORS
W. E. Wilson Jan. 1971 45 p refs
(SC-TM-710001) Avail: NTIS

Design principles and operating characteristics of two basic pulser types, the line and hard tube modulators, are described and related to a simple equivalent circuit. Requirements placed on a modulator when it is used to operate an LSA or TRAPATT oscillator are specified after consideration of the individual oscillator current-voltage characteristics. Operating characteristics of two experimental high voltage modulators, a hard tube type employing a series-parallel transistor switch and a line type employing an SCR switch, are described when operated with both resistive loads and a 100-watt LSA oscillator. The transistor modulator is shown to be more flexible than the SCR modulator, having a pulse width and a response time which are determined by the trigger pulse. The shape of the output voltage pulse is observed to change when load resistance, source voltage, and trigger pulse shape are varied for both modulators. Author

N71-34220# European Organization for Nuclear Research, Geneva (Switzerland).
HIGH-VOLTAGE MULTICHANNEL PULSE GENERATOR [GENERATEUR D'IMPULSIONS HAUTE TENSION A CANAUX MULTIPLES]
E. S. Belyakov et al Mar. 1971 8 p refs Transl. into FRENCH from Russian report ERFI-MLE-69-2 In FRENCH
(CERN-Trans-71-6) Avail: AEC Depository Libraries

A description is given of a high-voltage multichannel pulse generator equipped with six outputs. The pulses of the output can have an amplitude of 2 to 20 kV. The generator is triggered by a pulse of any polarity having an amplitude of approximately 500 V. The delay of the generator is 17 nanoseconds for an output pulse of 4.4 kV and 38 nanoseconds for an output pulse of 18.5 kV, the front of the high voltage pulse being equal respectively to 1.5 and 4.0 nanoseconds. The energy storage in the generator reaches approximately 6 joules. Author (NSA)

N71-34221# McElroy (Ralph) Co., Austin, Tex.
HOLLOW-CATHODE DISCHARGE WITH CONCENTRIC SPHERICAL ELECTRODES
F. Waechter et al [1971] 3 p refs Transl. into ENGLISH from Phys. Lett. (Amsterdam), 28A, 1969 p 370
(RFP-Trans-68) Avail: NTIS

The discharge tube was built in three different configurations and has four electrodes. The spherical electrode in the center is surrounded by two cups made of aluminum, which are separated from each other by a ring-shaped electrode. This forms the second spherical surface. Diagrams of the volt-ampere characteristics of the device are given. Author (NSA)

N71-34222# Bendix Corp., Kansas City, Mo.
FAST RECOVERY TIME DIODE TESTING Final Report
R. R. Flowers Mar. 1971 47 p refs
(Contract AT(29-1)-613)
(BDX-613-315) Avail: NTIS

A high-speed switching diode test system was assembled for the purpose of developing diode test techniques in the 400-picosecond time region. The effects of changes in the forward and reverse bias currents on the reverse recovery time of three diode types were measured. A relationship between the total reverse recovery time and the risetime of the leading edge of the diode switching pulse was noted. It is believed that the ultrafast diodes switch to a maximum reverse current bias condition at a faster rate than does the total risetime of the test system. For this reason, the accuracy of the reverse recovery time measurements of these diodes is questionable. A desired maximum of 10-percent error cannot be achieved with equipment available. Author

N71-34223# Technische Hochschule Munchen (West Germany).
MAGNETICALLY TUNABLE YIG TUNNEL DIODE OSCILLATORS ABOVE 1 GHz [MAGNETISCH DURSCHSTIMMBARE YIG-TUNNELDIODEN-OSZILLATOREN OBERHALB 1 GHZ]
Horst Bassenberg (Ph.D. Thesis) 15 Oct. 1970 22 p refs In GERMAN
Avail: NTIS

A 3.8 to 7.1 GHz resonance tunable tunnel diode oscillator with YIG-filters is developed through a special magnetic arrangement. The initial phase during oscillator activation, the coupling of the sphere to the excited negative resistance, and the synchronous behavior of the YIG tunnel diode oscillator are calculated. Transl. by G.G.

N71-34224# Technische Hochschule Munchen (West Germany).
ANALOG CALCULATION FOR TWO- AND THREE-DIMENSIONAL ELECTRON PATHS IN ELECTROSTATIC IMAGE CONVERTER [ANALOG-BERECHNUNG VON ZWEI- UND DREIDIMENSIONALEN ELEKTRONENBAHNEN IN ELEKTROSTATISCHEN BILDWANDLERN]
Dietrich Steffen (Ph.D. Thesis) 1970 100 p refs In GERMAN
Avail: NTIS

The design of an analog automatic electron trajectory tracer for studying imaging properties of electrostatic image converters is discussed. The apparatus used the analogy to an electrolytic water plotting tank to reproduce the electric field for measuring field strength components by tracer sonde. Position coordinates for particle trajectories are calculated by double integration of field strength components and the computer directs a servo-positioning system that shifts the tracing sonde geometrically along the trajectory curve. Transl. by G.G.

N71-35039*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SOLID-STATE POWER CONTROLLERS
Jack C. Boykin, William C. Stagg, and Donald E. Williams *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 106-132 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35041*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE CONNECTOR DEVELOPMENT
B. J. Mc Peak and W. J. Shockley *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 143-176 refs refs 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35042*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE ELECTRIC POWER DISTRIBUTION CONSIDERATIONS
J. L. Felch *In its* Proc. of the Space Shuttle Integrated Electron.

Conf., Vol. 2 1971 p 177-182 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35047*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT INTEGRATED PARAMETRIC AMPLIFIER DEVELOPMENT
P. H. Dalle Mura *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 279-290 refs 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35062*# United Aircraft Corp., Norwalk, Conn. Norden Div.
DESIGN OF CATHODE RAY TUBE DISPLAYS FOR THE SPACE SHUTTLE
G. F. Conron *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 221-250 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35064*# International Business Machines Corp., Oswego, N.Y. FSD Electronics System Center.
MULTIPURPOSE DISPLAYS FOR SPACE SHUTTLE
A. P. Yeager, Z. G. Tygielski, and F. L. Holmes *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 289-308 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35068*# Martin Marietta Corp., Denver, Colo.
SOLID STATE SEQUENCER SYSTEM
David E. Leck *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 359-378 refs (See N71-35052 21-31)
Avail: NTIS CSCL 22B

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N71-34225*# Electro-Mechanical Research, Inc., College Park, Md.
RADIATION EFFECTS IN MOS INTEGRATED CIRCUITS
Final Report, 20 Oct. 1969 - 20 Oct. 1970
Sidney S. Brashears and M. P. R. Thomsen Oct. 1970 17 p refs
(Contract NAS5-21106)
(NASA-CR-121623; Rept-6341-1994) Avail: NTIS CSCL 09C

Integrated circuits containing MOSFETs were subjected to 1 MeV electron. Damage and annealing rates were measured as a function of irradiation dosage, dose rate, annealing temperature, and composition of MOSFET components. Author

N71-34226*# Naval Ordnance Lab., White Oak, Md. Chemical Engineering Div.
ELECTRONIC CIRCUITRY FOR A HIGH INTENSITY FLASHLAMP
Harry E. Cleaver 21 Jul. 1971 14 p refs
(NASA Order C-77578)
(NASA-CR-120784; NOLTR-71-130) Avail: NTIS CSCL 09C

A Garton-Charatis flashlamp was used with the ballistic piston compressor for absorption spectroscopy measurements in the ultraviolet region. The power circuits needed to produce the high pulse currents required in the operation of the flashlamp are presented. Author

N71-34227*# Princeton Univ., N.J. Guggenheim Aerospace Propulsion Labs.
ANODE PHENOMENA IN HIGH-CURRENT DISCHARGES
Ronald C. Oberth (Ph.D. Thesis) Dec. 1970 148 p refs
(Grant NGL-31-001-005)
(NASA-CR-121737; Rept-961) Avail: NTIS CSCL 09C

An experimental investigation of a large-radius pinch discharge revealed that the cylindrical current sheet develops a broad and diffuse anode attachment which, under certain conditions, divides into two distinct regions of high current density. Furthermore, the existence of precursor current conduction at downstream anode locations was inferred from data which showed a substantial increase in arc voltage in response to insulation of the central portions of the pinch anode. Other experiments indicated that both of the above noted anode phenomena occur in a parallel-plate accelerator, and also that the analogous cathode processes arise at somewhat later times in the discharge history. Experimental study of various anode processes in a quasi-steady MPD arc clarified certain aspects of the current conduction and power loss mechanisms in these devices. Measurements of anode fall voltage and local anode current density at matched operating conditions defined and overall inverse relationship between these two quantities which is reciprocal in form. This result translates into a significant decrease in fractional anode power loss for quasisteady MPD arc operation in the megawatt range of pulse power. Author

N71-34228*# Research Triangle Inst., Durham, N.C.
STUDY OF CONDUCTION OF METALLIC LAYERS IMPLANTED IN AMORPHOUS LAYERS Research Report, May 1970 - Jul. 1971
R. P. Donovan Sep. 1971 28 p refs
(Contract NAS1-9996)
(NASA-CR-111953) Avail: NTIS CSCL 09C

Investigation of the electrical properties of metallic layers implanted into amorphous oxide glass did not identify any conduction attributed to the implanted metallic layer. Resistors of various magnitudes and temperature coefficient were measured but these were the properties of other conducting paths rather than the properties of the implanted layer. The extraneous conducting paths which dominate the measurements included: surface deposit resulting from exposure of the oxidized silicon to the implanting beam (this film could be removed by an oxygen plasma cleaning step similar to those becoming popular for the removal of photoresist films), and a path defined by aluminum penetration through the oxide to the underlying silicon (this path was negligible until the annealing temperature exceeded 550 C). The failure to observe electrical conductivity caused by implantation at the fluences and energies employed suggests that one or more of the assumptions of the experiment are invalid. Author

N71-34229# Aeronautical Research Labs., Melbourne (Australia).
CURVE TRACER FOR SERVO MOTORS, PART 2
G. Garfield Oct. 1970 30 p ref
(ARL/Sys-25) Avail: NTIS

The electronic control circuitry of a curve tracer designed for experimental determination of the torque-speed characteristics of electrical servomotors is described. The tracer automatically produces a family of torque-speed curves with armature voltage as a parameter. Author

N71-34230# Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND REGULATION THEORY
23 Aug. 1971 13 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 198, no. 2, 1971 p 303-309
(JPRS-53885) Avail: NTIS

CONTENTS:

1. PRODUCTION OPERATION PLANNING AND CONTROL OF COMPLEX CHEMICAL ENGINEERING SYSTEMS V. V. KAFAROV p 1-6 (See N71-34231 21-10)

2. OPTIMUM STABILIZATION OF SEVERAL COORDINATES OF AN OBJECT BY ONE CONTROLLING INFLUENCE V. B. Larin p 7-12 (See N71-34232 21-10)

N71-34231# Joint Publications Research Service, Washington, D.C.

PRODUCTION OPERATION PLANNING AND CONTROL OF COMPLEX CHEMICAL ENGINEERING SYSTEMS

V. V. Kafarov et al *In its* Cybernetics and Regulation Theory 23 Aug. 1971 p 1-6 refs (See N71-34230 21-10)
Avail: NTIS

An investigation was made to determine the possibility of extending the framework of problems with fixed endpoints for the solution of a control problem involving a complex chemical engineering system with continuous production processes. A mathematical model was developed for control of the production activity of the system possessing inherent characteristics of multidimensionality, multiinterconnectivity, and multiple decision levels. In the fully developed model the complex system is represented not only by dynamic, but also by heuristic and logic elements. D.L.G.

N71-34232# Joint Publications Research Service, Washington, D.C.

OPTIMUM STABILIZATION OF SEVER COORDINATES OF AN OBJECT BY ONE CONTROLLING INFLUENCE

V. B. Larin et al *In its* Cybernetics and Regulation Theory 23 Aug. 1971 p 7-12 refs (See N71-34230 21-10)
Avail: NTIS

The problem of synthesis of an optimal linear system of stabilization is considered. It is pointed out that the usual solution involves reduction to the status of a Wiener-Hopf equation of an optimum filter transfer function with subsequent determination of the desired transfer functions of the control. However, the lack of poles of the transfer function of the closed system in the right half-plane does not guarantee its stability because of the possible cancellation of zeroes and poles. In order to resolve this aspect of the problem a solution algorithm is introduced, based on a special choice of the function being varied in the Wiener-Hopf equation, which assures the stability of the closed system. D.L.G.

N71-34233# Technische Hogeschool, Eindhoven (Netherlands). Afdeling der Elektrotechniek.

MEASUREMENTS OF TIME CONSTANTS ON CASCADE dc ARC IN NITROGEN

V. Kalasek Feb. 1971 31 p refs
(TH-71-E-18; ISBN-90-6144-018-1) Avail: NTIS

Results of measurements on a cascade arc in local thermodynamic equilibrium with 5 mm bore diameter in nitrogen are presented. Electrical time constants up to 50 amp dc current were derived for 1 atm nitrogen pressure. Two exponentials were found, in general, in the decay of the voltage response on a current step (with exceptions of small arc currents). Relations between different definitions of time constants and arc current are graphically illustrated. Author

N71-34234# Technische Hochschule, Darmstadt (West Germany).

SYNTHESES OF FREQUENCY-INDEPENDENT (N PLUS 1)-POLE CIRCUITS WITH ACTIVE ELEMENTS [SYNTHESE FREQUENZUNABHAENGIGER (N+1)-POLSCHALTUNGEN MIT AKTIVEN ELEMENTEN]

Dirk Roedler (Ph.D. Thesis) 22 Dec. 1969 22 p refs In GERMAN
Avail: NTIS

A general synthesis method is developed for real, frequency- and time-independent (n+1)-pole circuits, followed by a specialization to certain network structures and to certain active elements. Circuits are derived for a number of three-terminal converters as examples. Author

N71-34235 National Lending Library for Science and Technology, Boston Spa (England).

INTERNAL INDUCTANCES OF CYLINDERICAL MAGNETIC CONDUCTORS

I. Cetin 1971 10 p refs Transl. into ENGLISH from Bull. Ass. Suisse Elec. (Switzerland), v. 58, 22 July 1967 p 682-687 In ENGLISH and GERMAN
(NLL-EE-Trans-1931(3774.5)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The analysis of the inner inductance of a current carrying circular conductor with respect to the outer inductance is discussed. The situations existing with alternating current and direct current are examined. The energy of self inductance is defined as the ratio between double the area obtained between the flux linkage axis and the magnetic characteristics up to the end point and the square of the current. Author

N71-35040*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.

AN AUTOMATIC ELECTRICAL DISTRIBUTION SYSTEM

M. A. Geyer *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 133-142 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-34236*# McDonnell Aircraft Corp., St. Louis, Mo.

HYPERSONIC RESEARCH FACILITIES STUDY. VOLUME 2, PART 1: RESEARCH REQUIREMENTS AND GROUND FACILITY SYNTHESIS. PHASE 1: PRELIMINARY STUDIES

2 Oct. 1970 571 p
(Contract NAS2-5458)
(NASA-CR-114323; MDC-A0013-Vol-2-Pt-1) Avail: NTIS CSCL 14B

A study was conducted to compare the characteristics of hypersonic research facilities considering research capability, versatility, adaptability, system confidence, and costs. The results of the research requirements analysis and the design and cost synthesis of the ground facilities are presented. D.L.G.

N71-34237*# McDonnell Aircraft Corp., St. Louis, Mo.

HYPERSONIC RESEARCH FACILITIES STUDY. VOLUME 3, PART 1: RESEARCH REQUIREMENTS AND GROUND FACILITY SYNTHESIS. PHASE 2: PARAMETRIC STUDIES

2 Oct. 1970 397 p refs
(Contract NAS2-5458)
(NASA-CR-114325; MDC-A0013-Vol-3-Pt-1) Avail: NTIS CSCL 14B

Based on the results of a previous study, which compared the characteristics of a broad group of flight research and ground research facilities, parametric studies were initiated to refine the facility designs and obtain sensitivity information in the neighborhood of near optimum designs, and to select those

facilities that appear most attractive in the sense of research potential vs cost for futher refinement. The results are presented of the research requirements analysis and the synthesis of the ground research facilities. D.L.G.

N71-34238*# McDonnell Aircraft Corp., St. Louis, Mo.
HYPERSONIC RESEARCH FACILITIES STUDY. VOLUME 4, PART 2: GROUND RESEARCH FACILITIES. PHASE 3: FINAL STUDIES
2 Oct. 1970 346 p refs
(Contract NAS2-5458)
(NASA-CR-114328; MDC-A0013-Vol-4-Pt-2) Avail: NTIS CSCL 14B

A previous study identified five facilities, out of eleven considered, as those which could provide the necessary technological increment at minimum costs. The present study involved refining the definition of the equipment and components associated with the five facilities to improve the base from which detailed cost estimates and development assessments were made. The results are presented of the analysis of the ground research facilities which refined the description of the more favorable concepts. D.L.G.

N71-34239*# McDonnell Aircraft Corp., St. Louis, Mo.
HYPERSONIC RESEARCH FACILITIES STUDY. VOLUME 4, PART 3: RESEARCH REQUIREMENTS ANALYSIS AND FACILITY POTENTIAL PHASE 3: FINAL STUDIES
2 Oct. 1970 211 p refs
(Contract NAS2-5458)
(NASA-CR-114329; MDC-A0013-Vol-4-Pt-3) Avail: NTIS CSCL 14B

A series of studies was conducted to assess the research requirements for hypersonic aircraft and define several desirable hypersonic research facilities based on these requirements. The results of these studies are summarized and include: (1) definition of the major research tasks applicable to operational hypersonic systems, (2) design of two attractive flight research vehicles and five conceptual ground research facilities, and (3) a quantitative evaluation of individual facility capability to accomplish the identified research tasks. D.L.G.

N71-34240*# Research Triangle Inst., Durham, N.C. Engineering and Environmental Sciences Div.
AN ANALYTICAL INVESTIGATION OF ACQUISITION TECHNIQUES AND SYSTEM INTEGRATION STUDIES FOR A RADAR AIRCRAFT GUIDANCE RESEARCH FACILITY, PHASE 2
W. S. Thompson Jul. 1971 109 p refs
(Contract NAS1-8912)
(NASA-CR-111931) Avail: NTIS CSCL 14B

User requirements and instrumentation plans are presented for upgrading an aircraft tracking and guidance facility. The present system tracking will be replaced with an FPS-16 radar supplemented by a laser tracker permanently mounted on the antenna. A real-time data handling system for receiving and processing digital tracking data and supply real-time outputs in digital or analog form is included. Investigations have determined that position accuracies of near touchdown + or - 1 ft and + or - 1/2 ft/sec in the vertical direction and + or - 2 ft and + or - 1 ft/sec in the horizonal directions can be achieved. E.M.C.

N71-34241*# Kernforschungsanlage, Juelich (West Germany). Zentralabteilung Strahlenschutz.
CENTRAL RADIATION PROTECTION DIVISION Progress Report, 1969
M. Keller, (ed.) and R. Tzschaschel, (ed.) Jul. 1970 272 p refs in GERMAN, ENGLISH summary
(JUL-670-ST) Avail: AEC Depository Libraries

The Radiation Protection Division of the Nuclear Research Establishment is responsible for the radiation protection of personnel, installations, and monitoring of the environment. This includes the introduction of methods and procedures according to the most recent knowledge of science and research. Activities during 1969 are reported. NSA

N71-34242*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
ALTITUDE SIMULATION CHAMBER FOR ROCKET ENGINE TESTING Patent Application
John W. Davis, inventor (to NASA) and Herschel W. Belen, Jr., inventor (to NASA) Filed 21 Jun. 1971 14 p
(NASA-Case-MFS-20620; US-Patent-Appl-SN-154935) Avail: NTIS CSCL 14B

A vacuum chamber, simulating high pressure altitude conditions, for testing a scale model of a space vehicle in short durations runs is described. To dissipate the engine exhaust energy, and particularly the starting shock wave produced when the engine is fired, an energy absorbing compartment is provided within the chamber. The compartment is composed of cryogenically cooled metal honeycomb panels supported by the wall of the vacuum chamber. The cells of the honeycomb panels are opened on the inner side of the panels to present a large, cold and confining surface area to dissipate the energy of the exhaust gas molecules by capturing and freezing the molecules within the honeycomb cells. NASA

N71-34243*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF DIFFUSERS, SHROUDS, AND MASS INJECTION ON THE STARTING AND OPERATING CHARACTERISTICS OF A MACH 5 FREE JET TUNNEL
John K. Molloy, Ernest A. Mackley, and J. Wayne Keyes Washington Sep. 1971 31 p refs
(NASA-TN-D-6377; L-7659) Avail: NTIS CSCL 14B

Supersonic flow with a high blockage model was studied and model tunnel test section configuration was devised which would allow flow establishment (tunnel starting) at low pressure ratios. The model had a cross-sectional area equal to approximately 50 percent of the nozzle exit area. Two tunnel diffuser sizes with some combinations of model shroud configurations, and Mach 4 annular injectors at the nozzle exit and the diffuser entrance were investigated. Starting pressure ratios on the order of 50 and ratios of chamber pressure to free stream static pressure of 1.0 were obtained during these tests. Author

N71-34244# Australian Post Office Research Labs., Melbourne.
A STANDARD FREQUENCY AND TIME SIGNAL INSTALLATION: VNG, LYNDHURST, VICTORIA
I. P. MacFarlane Aug. 1970 42 p refs
(Rept-6475) Avail: NTIS

The Standard Frequency and Time Signal Service operated by the Postmaster-General's Department, from Lyndhurst, Victoria, Australia, is discussed. Carrier frequencies are stablized and the epoch of the time signals is controlled with relation to the UTC frequency and time scales maintained by the frequency standards division of the P.M.G. research laboratories. The service is provided mainly for the use of astronomical surveyors, government departments and instrumentalities, seismic and geophysical surveyors and observatories, academic institutions, private industry and similar groups in Australia and its territories. Author

N71-34245# RAND Corp., Santa Monica, Calif.
MEASUREMENT AND EVALUATION OF ALTERNATIVE REGIONAL TRANSPORTATION MIXES. VOLUME 1: SUMMARY
Frederick S. Pardee, Charles T. Phillips, and Keith V. Smith Aug. 1970 56 p refs
(Contract DOT-FR-9-0054)
(RM-6324-DOT-Vol-1) Avail: NTIS

A methodology for evaluating the potential benefit of alternative transportation proposals for a region, and a

condensed example illustrating the application of the methodology are presented. The methodology is relevant to major needs in transportation planning, for example, evaluating improvements in service provided by various mixes of modes, helping engineering designers specify performance features for new systems, measuring impacts on different interest groups in society, and formulating appropriate mixes of transportation policies. At the outset, an illustrative set of objectives for improved transportation service is provided, together with a hierarchy of policy options which suggest alternative ways of satisfying these objectives. This is followed by a cataloging of the interest groups to whome the benefits from improved service may accrue. Author

N71-34246# RAND Corp., Santa Monica, Calif.
MEASUREMENT AND EVALUATION OF ALTERNATIVE REGIONAL TRANSPORTATION MIXES. VOLUME 2: METHODOLOGY
Frederick S. Pardee, Charles T. Phillips, and Keith V. Smith Aug. 1970 137 p refs
(Contract DOT-FR-9-0054)
(RM-6324-DOT-Vol-2) Avail: NTIS

A methodology for evaluating transportation service, with emphasis on the measurement of its effectiveness, is presented. The transportation services considered are regional in scope. The travel considered is primarily intercity. Apart from the interface between intercity and local travel, the local travel problem has not been handled. It is assumed that a planning or analysis group has been given the task of improving the quality of transportation between cities in a given geographical region. Emphasis is on a range of methods that the planning group can use in various contexts. The methods vary in the effort involved, in the level of specified detail, and in the degree of quantification of the variables. Each of the methods is intended to be comprehensive in taking account of all significant determinants of transportation effectiveness. Author

N71-34247# RAND Corp., Santa Monica, Calif.
MEASUREMENT AND EVALUATION OF ALTERNATIVE REGIONAL TRANSPORTATION MIXES. VOLUME 3: EXAMPLE
Frederick S. Pardee, Charles T. Phillips, and Keith V. Smith Aug. 1970 148 p refs
(Contract DOT-FR-9-0054)
(RM-6324-DOT-VOL-3) Avail: NTIS

A detailed methodology for evaluating alternative proposed changes to an existing mix of transportation modes is presented. The setting for the example is a geographical region that is part of the Northeast Corridor of the United States. Two alternative environments and three alternative transportation mixes are specified for the region over the 1970 to 2000 time period. Populations in the region's cities and distributions within these cities are assumed for each environment. Two separate evaluations are performed to determine region-wide user benefits. The first is performed without extensive computer assistance. It determines worth information in an aggregated manner for the transportation network as a whole. The second is a computer-oriented method that determines worth information for each possible trip in a network, using a shortest path algorithm to specify the trip--including access, egress, and transfer links. Both evaluations produce a variety of summary information and, if desired, will generate a single measure of worth combining a large number of user attributes. Author

N71-34248# RAND Corp., Santa Monica, Calif.
COST SENSITIVITY ANALYSIS OF A GROUND SENSOR SYSTEM
K. K. Weaver Apr. 1970 12 p
(P-4361) Avail: NTIS

Cost sensitivity analysis is defined as the systematic investigation of the relationship of total system costs and system design and cost parameters. The basic reason for sensitivity analysis is cited as the uncertainties present when the total cost of some system is evaluated. Examples are given to show how the range of uncertainty can vary from parameter to parameter. To illustrate the use of the cost sensitivity analysis technique, a typical cost analysis study is presented on a ground sensor system for use in locating enemy targets. Author

N71-34249# California Univ., Berkeley. Lawrence Radiation Lab.
BEVATRON OPERATION AND DEVELOPMENT, 66, JANUARY THROUGH MARCH 1970
Kenneth C. Crebin and Robert Fries 12 Jan. 1971 14 p refs
(Contract W-7405-eng-48)
(UCRL-20249) Avail: NTIS

The bevatron resumed operation January 6, 1970 after a sixweek shutdown. A new septum beam split was installed in the F1 Channel 1 region. Details of the operation and backstop region of the new beam are discussed. The bevatron operated for high energy physics 82.6% of the scheduled operating time and accelerated 2.9 X 10 to the 18th power protons during the first quarter of 1970. Nine new experiments were started. Pulse-to-pulse stability of the main magnet motor-generator sets is discussed. Author (NSA)

N71-34250# National Accelerator Lab., Batavia, Ill.
[ACCELERATOR FACILITY EQUIPMENT AND OPERATIONS] Monthly Report, period ending 30 Apr. 1971
F. T. Cole 30 Apr. 1971 13 p
(Contract AT(49-8)-3000)
(NAL-57) Avail: NTIS

Progress on the main accelerator, booster, linac, RF system, beam transfer system, and experimental facilities are outlined. NSA

N71-34251# California Univ., Livermore. Lawrence Radiation Lab.
THE LAWRENCE RADIATION LABORATORY OCTOPUS
Samuel F. Mendicino Apr. 1971 18 p Presented at the Courant Symp. Series on Networks, N. Y., 29 Nov. 1970 Sponsored by AEC
(UCRL-73149; Conf-701128-1) Avail: NTIS

A historical account of the evolution of the Lawrence Radiation Laboratory Livermore Octopus network is given. The evolution of the Octopus from a centralized network to a distributed one that consists of a superimposition of specialized sub-networks is described. The problems of reliability and stability in the centralized network that was constantly changing and expanding have been minimized by the shift to decentralization. Each of the sub-networks perform specific network functions. They are interconnected but relatively independent of one another so that failures in a part of the network do not cause catastrophic interruptions of overall network service. Author

N71-34252# California Univ., Berkeley. Lawrence Radiation Lab.
SUPERCONDUCTING PULSED SYNCHROTRON DIPOLE AND dc BEAM TRANSPORT MAGNETS
W. F. Eaton, W. S. Gilbert, R. A. Kilpatrick, R. B. Meuser, F. L. Toby et al Feb. 1971 4 p Presented at the Natl. Particle Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20188; CONF-710308-25) Avail: NTIS

Pulsed dipoles for superconducting synchrotron application were built and tested. Low cyclic loss up to a central dipole field of 23 KG was demonstrated. A large dc dipole transport element for the bevatron area use was built and tested; the warm bore aperture is 8 in. and the design central field is 42 KG. Details of the magnet and a companion quadrupole doublet are given. Author (NSA)

N71-34263# Advisory Group for Aerospace Research and Development, Paris (France).
INVENTORY OF ACOUSTIC FATIGUE TEST FACILITIES IN THE NATO COUNTRIES
B. L. Clarkson (Southampton Univ.) Jul. 1971 15 p refs
(AGARD-R-584-71; AGARD-Rept-584) Avail: NTIS

The acoustic test facilities for NATO are listed as of 1969. The characteristics of the noise generators including frequency range, sound levels, and typical spectrum provided are tabulated. The instrumentation and data analysis systems are also tabulated for each facility. F.O.S.

N71-35068*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
UNIFIED TEST EQUIPMENT: A CONCEPT FOR THE SHUTTLE GROUND TEST SYSTEM
Edgar A. Delke *In* NASA, Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 329-354 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

N71-35067*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
A STANDARD LANGUAGE FOR TEST AND GROUND OPERATIONS
Henry C. Paul *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 355-358 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-34254# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATIONS OF BLOWING IN A WATER TUNNEL BY FLOW VISUALIZATION [ESSAIS DE SOUFFLAGE AU TUNNEL HYDRODYNAMIQUE A VISUALISATION]
H. Werle Aug. 1971 63 p refs Transl. into ENGLISH of French report ONERA-NT-61, Sep. 1960 p 1-49
(Contract NASw-2038)
(NASA-TT-F-13742; ONERA-NT-61) Avail: NTIS CSCL 20D

The effects of blowing on flow around a great variety of models have been analyzed by means of flow visualizations produced using the ONERA water tunnel. Some examples have been extracted from these studies of high velocity flows. These are: (1) blowing tangential to the wall, blowing normal to the wall, and blowing at the end of a model; and (2) applications to problems of aerodynamics such as blowing on the wing flap, jet flap at the end of a wing, ground effect on a platform with jets, jet at the end of an aircraft, and a missile. Author

N71-34265*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF RANDOMLY FLUCTUATING PRESSURE GRADIENTS, WITH ARBITRARILY SPECIFIED POWER SPECTRUM AND PROBABILITY DENSITY, ON FLOW IN CHANNELS
Morris Perlmutter 1971 29 p refs Presented at Symp. on Turbulence in Liquids, Rolla, Mo., 4-6 Oct. 1971; Sponsored by Missouri Univ.
(NASA-TM-X-67881; E-6393) Avail: NTIS CSCL 20D

A longitudinal pressure gradient of a non-Gaussian form and arbitrary power spectrum will cause a randomly fluctuating velocity, to be superimposed on the steady incompressible flow in a channel. Pressure gradient and velocity correlations, frequency response functions, and system power loss are calculated. Numerical random pressure gradient signals were generated using Fourier series expansion, with random picking of discrete Fourier spectrum values and a nonlinear no-memory transformation. Numerical values of the velocity signal were calculated by linear transformation of the pressure gradient signal. Pressure gradient and velocity signals were compared for difference in amplitude, frequency, time lag, and probability distribution functions. Author

N71-34266*+ Pennsylvania State Univ., University Park. Coll. of Engineering.
SYSTEM AND CONTROLS LABORATORY
Oct. 1970 21 p refs
(Grant NGL-39-009-023)
(NASA-CR-121643; RR-12) Avail: NTIS CSCL 20D

Analytical and experimental methods concerned with advanced aerospace systems are reported. The following subjects are discussed: thrust modulation by vortex generation, fluid line dynamics, optimizer research, laminar jet wall reattachment, water table study of a mechanically deflected hydraulic jet valve, modeling of fluid amplifiers, and jet-receiver interaction effects on pressure and flow recovery characteristics of fluidic devices. E.M.C.

N71-34267*# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.
AN EXPERIMENTAL INVESTIGATION OF THE TURBULENT BOUNDARY LAYER UNDERGOING BOTH ADVERSE PRESSURE GRADIENT AND CROSS FLOW ALONG A PLANE OF SYMMETRY
Victor Zakkay, Wladimiro Calarese, and C. R. Wang Feb. 1971 44 p refs
(Grants NGL-33-016-067; NGR-33-016-161)
(NASA-CR-121635; F-71-1) Avail: NTIS CSCL 20D

Experimental data have been obtained for a compressible turbulent boundary layer in adverse pressure gradient with and without favorable cross flow along a plane of symmetry of a flared surface. The experiments were performed at Mach number 6 and Reynolds number up to 44 million/ft. The compression over the flared surface was of the order of 50. Transition was achieved naturally well ahead of the compression region and the cross flow was established by placing on the compression surface two lateral plates. Boundary layer profiles of static pressure, pitot tube pressure, stagnation temperature, and heat transfer rates were measured. Measurements were taken on the windward side of the surface. The presence of the cross flow alters significantly the value of the profiles. Heat transfer rates are in good agreement with theoretical values obtained by the flat plate reference enthalpy method. Present data will be used to calculate the Mach number and velocity profiles, together with the boundary layer parameters. Author

N71-34268*# Toronto Univ. (Ontario).
A PRELIMINARY MONTE-CARLO ANALYSIS OF THE REFLECTION OF AN IMPLODING HEMISPHERICAL SHOCK WAVE SIMILAR TO THAT GENERATED IN THE UTIAS IMPLOSION DRIVEN HYPERVELOCITY LAUNCHER OR SHOCK TUBE
A. K. MacPherson Nov. 1970 54 p refs
(Grant NGR-52-026-023)
(NASA-CR-121708; UTIAS-152) Avail: NTIS CSCL 20D

The reflection of a hemispherical imploding shock wave in argon was studied in the region very close to the center. Two aspects, which could not be studied by classical analysis, were the effect of a cold wall upon the reflection, and multibody collisional effects. The effect of the cold wall was examined using a Monte Carlo technique, comparing the results obtained when the wall was treated as specularly reflective and diffuse reflective. A substantial difference occurred near the center but it appeared that it would be rapidly damped. The multibody collisional effects were studied using a modified form of molecular dynamics. Reflection will occur before the imploding

shock reaches the center due to circumferential stresses in the shock. A refraction type phenomenon resulted with reflected and transmitted waves. Author

N71-34259*# Vanderbilt Univ., Nashville, Tenn. Dept. of Mechanical Engineering.
A STUDY OF JET IMPINGEMENT ON CURVED SURFACES FOLLOWED BY OBLIQUE INTRODUCTION INTO A FREESTREAM FLOW Annual Report, 1 Feb. 1969 - 31 Jan. 1970
John W. Tatom, Norman M. Schnurr, John. W. Williamson, and John H. Dunlap 15 Apr. 1971 117 p refs
(Grant NGR-43-002-034)
(NASA-CR-121736; AR-1) Avail: NTIS CSCL 20D

A study of the technology surrounding thrust reversers as particularly applied to Short Take Off and Landing (STOL) aircraft was initiated. The study is divided into two main subdivisions: (1) a study of jets introduced obliquely into a freestream flow, and (2) a study of jet impingement on curved surfaces. The former was further divided into an investigation of the flow field generated around a single engine nacelle by two hot, round opposing jets in the presence of a freestream, and an investigation of the hot, two-dimensional jet introduced at various angles into an opposing freestream. The results of the model nacelle testing suggest that pitching the reverse jet up asymmetrically is a useful technique for preventing engine exhaust ingestion and thereby increasing reverser utilization and performance. The study of jet impingement on curved surfaces was primarily an analytical effort. Experiments were performed for the purpose of verifying the assumptions on which the analysis is based. Satisfactory analytical and numerical solutions were obtained for a radial plane jet impinging on a cylindrical deflector and round radial jet impinging on a hemispherical surface. Author

N71-34260*# Purdue Univ., Lafayette, Ind. Fluid Mechanics Group.
SHOCK INDUCED BOUNDARY LAYER OVER A SEMI-INFINITE FLAT PLATE. PART 2: COMPLETE PROBLEM
Douglas E. Abbott and Michael I. O. Ero Dec. 1970 53 p refs
(Grant NGR-15-005-077; Proj. 5250 Proj. 5567)
(NASA-CR-121743; FMTR-70-2-Pt-2) Avail: NTIS CSCL 20D

The complete problem of shock induced boundary-layer flow on a semi-infinite flat plate is analyzed. A previous analysis which considered the flow only in the immediate vicinity of the shock wave was extended to include leading edge effects and served as the basis of the present study. Calculations are shown for this truly unsteady problem for both a perfect gas and a real gas in thermodynamic equilibrium. Results are presented for the boundary-layer growth as a function of time for various shock wave intensities. It is shown that the predicted asymptotic approach of the leading-edge flow to steady state values (as the shock wave moves farther and farther along the plate) agrees very well with experimental results based on wall heat transfer measurements. Results are also shown for the skin-friction coefficient and the Nusselt number for a range of shock intensities and shock wave locations. Author

N71-34261*# Texas A&M Univ., College Station. Aerospace Engineering Dept.
SUBSONIC, TRANSONIC AND SUPERSONIC NOZZLE FLOW BY THE INVERSE TECHNIQUE
David J. Norton Jul. 1971 46 p refs
(NASA-CR-121674; AED-R71-10) Avail: NTIS CSCL 20D

The use of an inverse method to describe two-dimensional gas dynamic flow fields of either rotational or irrotational character is dicussed. The governing equations for inviscid steady, axisymmetric flow are solved for several nozzle flow fields. These equations are solved numerically in a transformed system of coordinates representing the stream function and a stretched axial coordinate to permit maximum stability. One feature of the method of solution is that it permits a unified treatment of the subsonic (including initial conditions), the transonic, and the supersonic portions of a rotational flow. Author

N71-34262*# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
REFERENCE INCIDENCE ANGLES IN CONSTANT STAGGER CASCADES Interim Report
M. J. Miller and T. Skanberg Jun. 1971 75 p refs
(Grant NGL-16-002-005; ERI Proj. 626)
(NASA-CR-121679; ISU-ERI-AMES-99985) Avail: NTIS CSCL 20D

An empirically derived method of estimating the reference incidence angle for two-dimensional, plane cascades incorporates inlet flow angle as an indepedent variable and is convenient for design applications. For analysis applications however, this method is reformulated with stagger angle replacing inlet flow angle as an independent variable. The result is presented in graphical form and as a FORTRAN 4 computer program. Author

N71-34263*# Scientific Translation Service, Santa Barbara, Calif.
HOT WIRE MEASUREMENTS IN SUPERSONIC FLOW FOR INVESTIGATING A BOUNDARY LAYER WITH INJECTION [MESURES AU FIL CHAUD EN ECOULEMENT SUPERSONIQUE EN VUE DE L'ETUDE D'UNE COUCHE LIMITE AVEC INJECTION]
Michel Comil et al Washington NASA Sep. 1971 31 p refs
Transl. into ENGLISH from French report 70-2, publ. 368, Apr. 1970
(Contract NASw-2035)
(NASA-TT-F-13929) Avail: NTIS CSCL 20D

Measurements in the boundary layer of a flat plate using helium or argon injection are described. A hot-wire constant-temperature anemometer was used to measure the velocity and temperature profiles in supersonic flow. The variation of the Nusselt number downstream from the shock was investigated for Reynolds numbers in the range 1 less than Re2 less than 80 in this range the heat transfer evolves monotonically from continuous flow to free molecular flow. For low values of the Reynolds number, the heat transfer depends essentially on the gas studied. The thermal parietal coefficient varies from 0.95 for continuous flow to values greater than 1 for low Reynolds numbers. It will therefore be necessary to take those variations into account when making temperature measurements in the boundary layer. Author

N71-34264# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
AXISYMMETRIC NOZZLES FOR COMPRESSIBLE FLOW
M. J. Cohen and D. A. Nimery Apr. 1971 41 p refs
(TAE-122) Avail: NTIS

A method of designing three-dimensional axisymmetric ducts with stipulated axial velocity distributions in the compressible flow domain is presented. The solution for such flows is given in terms of the velocity potential expressed as a power series in the axial and radial coordinates. The convergence properties of such series solutions are examined, and the effect of compressibility in this context assessed. Only subsonic duct flows are considered. Three convergent cones with essentially incompressible, middle subsonic, and sonic delivery conditions, but with near optimum characteristics regarding wall pressure gradients, are derived. Author

N71-34265# Technische Hogeschool, Eindhoven (Netherlands).
ON THE HYDRODYNAMIC BEHAVIOUR OF PARALLEL BOILING WATER CHANNELS
Antonius Christianus Maria Van Vonderen (Ph.D. Thesis) 23 Mar. 1971 148 p refs
Avail: NTIS

The results are reported of an experimental and theoretical investigation using an experimental rig operated in natural or in forced circulation, and employing water as a test fluid. The test

section comprised three, uniformly heated, inside-cooled, boiling channels, which were connected to a common inlet and outlet plenum. The influence of pressure, inlet subcooling, and different combinations of channel orifices, on the steady-state and dynamic hydraulic characteristics were studied, as well as the influence of a pump on the stability of parallel channels. Prediction of experimental results was attempted with a nonlinear computer program that describes the hydrodynamics of three parallel boiling channels. Void fraction at two positions along the channel axis are presented for steady state experiments as a function of pressure, inlet subcooling, power, and channel inlet loss factor. A criterion for determining the onset of instabilities in the dynamic experiments is proposed. Instability threshold power, oscillation frequency, and the mode of oscillation are presented. Author

N71-34266# Kyoto Univ. (Japan). Dept. of Aeronautical Engineering.
STUDIES ON SHOCK WAVE STRUCTURE IN A NONEQUILIBRIUM, PARTIALLY IONIZED GAS FLOW
Michio Nishida 1969 246 p refs
Avail: NTIS

The performances of the low density plasma jet wind tunnel constructed at Kyoto University in 1964 are presented in detail and the possibility of free molecule flow region experiments is described. Moreover the plasma flows are diagnosed by several techniques including a Langmuir probe technique, a microwave interferometry, two electrodes method and a transducer method for electrical conductivity measurement, and an induction velometry. The theoretical analyses of the shock wave structure in a nonequilibrium, partially ionized gas flow are performed. The profiles of the electron temperature, the ion density, the ion temperature, and the induced potential gradient across the shock wave are obtained. Finally the experimental analyses of the shock wave structure are carried out in the plasma jet wind tunnel by using a Langmuir probe technique and an induction velometry, and measuring the electron temperature, the ion density, and the induced potential gradient across the shock wave. The experimental results are compared with the theoretical ones. Author

N71-34267# Sandia Labs., Albuquerque, N. Mex. Library Reference Div.
CRITERIA FOR THE DETACHMENT OF A THREE-DIMENSIONAL BOUNDARY LAYER
G. M. Bam-Zelikovich 12 Feb. 1971 17 p refs Transl. into English from Izv. Akad. Nauk SSSR (USSR), no. 4, 1970 p 50-54 Sponsored by AEC
(SC-T-71-3010) Avail: NTIS

The criteria of the detachment of a laminar and turbulent boundary layer during a three-dimensional flow are deduced, assuming that the character of the flow in a given cross section of a boundary layer depends solely on the behavior of the external stream. The criteria of the detachment appear to be the consequence of the necessary condition for a break-away of a three-dimensional boundary layer. Author

N71-34268# Rensselaer Polytechnic Inst., Troy, N.Y.
STUDIES OF GAS PARTICLE HEAT TRANSFER COEFFICIENTS IN PACKED AND FLUIDIZED BEDS BY FREQUENCY RESPONSE TECHNIQUES Annual Progress Report, 1 Jan. 1970 - 28 Feb. 1971
Howard Littman Mar. 1971 6 p refs
(Contract AT(30-1)-3639)
(RPI-3639-16) Avail: NTIS

The measurement and correlation of gas-particle heat transfer coefficients in packed beds are reported. A method for determining bubble rise velocities and pressure changes around single bubbles in gas fluidized beds and analysis of the pressure field around two-dimensional bubbles are discussed. The statistical analysis of pressure fluctuations in a fluidized bed is also included. J.M.

N71-34269# Sandia Labs., Albuquerque, N. Mex. Aero-Fluid Dynamics Div.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF A LIQUID FILM INTERACTING WITH A SUPERSONIC STREAM
William S. Saric [1971] 11 p refs Supported by AEC
(SC-DC-713922) Avail: NTIS

Certain missions have been proposed that require a heat protection system that is impractical using conventional techniques. The concept of transpiration-cooled nose tips (TCNT) is being seriously considered as the best method of providing such protection. The regions of stable and unstable behavior of the liquid-gas configuration that are present in transpiration-cooled systems are described. The interaction of the liquid layer interface with a supersonic gas stream (laminar or turbulent) to analyze the nature of liquid entrainment and blow-off and to evaluate the aft cooling of the transpirant. Author

N71-34270# Sandia Labs., Albuquerque, N. Mex.
METHODS FOR PREDICTING TURBULENT JET MIXING
J. L. Merk Dec. 1970 41 p refs
(SC-DR-70-836) Avail: NTIS

A review was made of existing theoretical treatments of jet flow, with emphasis on turbulent axisymmetric free jets, with and without swirl. It was found that most treatments rely on experimentally determined parameters in formulation of the eddy viscosity term. The analysis of swirling, turbulent jets relies heavily on experimental data, particularly for viscosity and velocity profile predictions. Author

N71-34271# Sandia Labs., Albuquerque, N. Mex.
CAVITATION STUDY OF UNDERWATER TRAJECTORY
1 Apr. 1971 22 p
(SC-DC-71-713982) Avail: NTIS

Testing methods and techniques for the study of the cavitation that occurs with high speed underwater projectiles are discussed. General problems of underwater projectile trajectory calculation and simulation are summarized. A description of the test facility and the results are included. J.M.

N71-34272# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
THE RELAXATION OF A TURBULENT SHEAR LAYER AFTER REATTACHMENT
P. Bradshaw and F. Y. F. Wong Mar. 1971 40 p refs
(IC/71/05) Avail: NTIS

Existing experiments on the flow downstream of steps and fences, and some new measurements behind a backward-facing step, are used to demonstrate the complicated nature of the flow in the reattachment region and its effect on the very slow (and non-monotonic) return of the shear layer to the ordinary boundary layer state. Author

N71-34273# McGill Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
DYNAMICS OF SUBMERGED TOWED CYLINDERS
M. P. Paidoussis [1970] 35 p refs Presented at the 8th Symp. on Naval Hydrodynamics, Session 8, Pasadena, Calif. 28 Aug. 1970
(MERL-TN-70-4) Avail: NTIS

The dynamics of towed bodies of simple geometry was examined in order to identify parameters affecting stability. The dynamics of flexible towed bodies of revolution was reexamined to determine the relation between rigid and flexible bodies. A practical application is the submerged oil barge, towed behind a small submarine, for transportation of liquid cargoes to and from Arctic ports. The system may be subject to rigid body instabilities at low towing speeds and to flexural instabilities at higher towing speeds. It was shown that a rigid or flexible system can be stabilized by manipulation of the length of the tow rope only in terms of oscillatory instabilities. Yawing is not affected. A most important parameter affecting stability is the

shape of the tail end of the body. The use of flexible or articulated towed systems, instead of rigid ones, is advocated.
Author

N71-34274*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MIXING OF HYDROGEN INJECTED FROM MULTIPLE INJECTORS NORMAL TO A SUPERSONIC AIRSTREAM
R. Clayton Rogers Washington Sep. 1971 35 p refs
(NASA-TN-D-6476; L-7896) Avail: NTIS CSCL 20D

The mixing of hydrogen downstream from a row of sonic injectors normal to a Mach 4 airstream was investigated to determine the effect of injector spacing. Injectors at spacings of 12.5 and 6.25 injector diameters were operated at ratios of jet dynamic pressure to free stream dynamic pressure between 0.5 and 1.5. Nominal free stream conditions were a stagnation temperature of 300 K and stagnation pressures of 1.38 and 2.07 MN/sq m. Turbulent boundary layer thickness at the injection station was 2.70 injector diameters. Measurements of hydrogen volume fraction and pitot and static pressures were made between 7 and 200 injector diameters downstream from the injectors. Results of the investigation indicated that the hydrogen penetration trajectory was not appreciably different from single injector results, being proportional to the 0.300 power of the dynamic pressure ratio. Maximum concentration decay with downstream distance for the wider injector spacing was correlated with the ratio of jet mass flux to free stream mass flux; for the closer spacing, the rate of decay of the maximum concentration was inversely proportional to the 0.286 power of the ratio of jet mass flux to free stream mass flux.
Author

N71-34275# Boeing Co., Seattle, Wash. Aerospace Group.
THE NUMERICAL CALCULATION OF PLANE STEADY TRANSONIC FLOWS PAST LIFTING AIRFOILS
James A. Krupp (Ph.D. Thesis - Washington Univ.) Jun. 1971 129 p refs
(D180-12958-1) Avail: NTIS

Numerical solutions of the transonic potential equation for flow past lifting airfoils with free stream Mach number less than unity are presented. The work is based on the method of Murman and Cole. Modifications to the basic finite difference equations are discussed which yield improved resolution of weak shock and greater accuracy near the sonic line. The proper treatment of boundary conditions and the Kutta condition are discussed in detail. Extensive computations for four airfoils are presented and the results are compared with theory and experiment where applicable.
Author

N71-34276# Lockheed Missiles and Space Co., Palo Alto, Calif.
UNSTEADY VISCOUS GAS FLOW BETWEEN TWO SOLID WALLS, ONE OF WHICH IS FREE AND VIBRATES AT HIGH FREQUENCY
V. A. Biushkin et al 1971 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 2, 1971 p 111-116
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The general equation of the pressure distribution in a thin viscous gas layer between two solid walls of arbitrary shape was developed. To investigate the quasistationary process in the gas layer, the free solid wall was allowed to vibrate at high frequency with no low frequency vibrations. The unsteady gas layer motion was investigated by allowing motion to occur in addition to the free wall vibrations. The plane gas motion between walls was then considered with an arbitrary perturbation superposed on the high frequency vibration of the freely vibrating wall. Finally, the stability of the free solid wall was considered.
J.G.M.

N71-34277# Lockheed Missiles and Space Co., Palo Alto, Calif.
NONEQUILIBRIUM VISCOUS FLOW OF A MULTICOMPONENT GAS IN THE NEIGHBORHOOD OF THE STAGNATION POINT OF A BLUNT BODY
V. G. Voronkin 1971 6 p refs Transl. into ENGLISH from Izv. Akad Nauk SSSR, Mekh. Zhidk. Gaza (USSR), no. 2, 1971 p 144-147
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The case of a multicomponent nonequilibrium dissociating air on a wall with finite catalytic activity in the neighborhood of the stagnation point of spherical bluntness is considered. Some results are presented of numerical computations characterizing the influence of variability of the parameters in the shock layer on the heat exchange occurring in this case. It is shown that taking account of the variability of the parameters in a nonequilibrium shock layer results in an essential increase in the heat flux to the non-catalytic wall as compared with the theory of an asymptotically thin nonequilibrium boundary layer with equilibrium parameters on its outer boundary.
Author

N71-34278# Technische Hogeschool, Delft (Netherlands).
WAKE ADAPTED DUCTED PROPELLERS
Marinus Willem Cornelis Oosterveld (Ph.D. Thesis) 1970 130 p refs
(Contracts N62558-3999; N62558-4555)
Avail: NTIS

Experiments with ship propellers are described which utilize either a ducted propeller where the nozzle accelerates the flow at the propeller or one where the nozzle decelerates the flow. The potentialities of both propellers are discussed based on simplified theories. Open-water test results of systematic series of flow accelerating and flow decelerating nozzles are given as well as results of tests with ringpropellers and ringpropellers in nozzles. The design and application of nonaxisymmetrical nozzles which are adapted to the wake behind a ship are dicussed for both single- and double-screw ships.
Author

N71-34279# National Bureau of Standards, Washington, D.C. Building Research Div.
SURFACE PRESSURE FLUCTUATIONS NEAR AN AXISYMMETRIC STAGNATION POINT
Richard D. Marshall Aug. 1971 66 p refs
(NBS-TN-563) Avail: SOD $0.70

Surface pressure fluctuations on a circular disk placed normal to a turbulent air stream was investigated. Turbulence intensities of approximately 10% were produced by a coarse grid installed at the test-section entrance. The turbulent field in the neighborhood of the disk was homogeneous and nearly isotropic. Experimental results indicate that existing linear theories which do not consider distortion of the flow fail to predict the nature of surface pressure fluctuations on a bluff body. Only for wavelengths which are large compared to the body do these theories yield satisfactory results. A strong attenuation of the high frequency components occurs as the flow stagnates. This is accompanied by a transfer of energy from short to long wavelengths. The opposite effect is observed as the flow attains a radial direction and approaches the edge of the disk. A neutral wavelength which undergoes little change in energy was observed. Integral scales of surface pressure fluctuations are much larger than the lateral integral scale of the free-stream turbulence.
Author

N71-34280# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
RECENT RESEARCH ON UNSTEADY BOUNDARY LAYERS
Jean Piquet and Radyadour Kh. Zeytounian 1971 26 p refs in FRENCH; ENGLISH summary Presented at the IUTAM Symp. on Unsteady Boundary Layers, Quebec, 25-29 May 1971
(TP-941) Avail: NTIS

The analytical methods used are based on the assumption that all parameters outside the boundary layer can be expanded in power series of the square root of (t), and that the problem of the unsteady boundary layer may be solved in a similar form. These methods make it possible to describe the initial, highly unsteady phase of the compressible boundary layer flow around

three-dimensional bodies. In the numerical method, finite difference techniques are applied to various types of unsteady boundary layer problems. The calculations performed using these two methods are briefly described. Author

N71-34281# Addis Translations International, Woodside, Calif.
GRADIENT ACCELERATION OF A SHOCK WAVE AND POSSIBLE APPLICATIONS OF THIS EFFECT [GRADIENT-NOE USKORENIE UDARNOI VOLNY I VOZMOZHNYE PRIMENENIYA ETOGO EFFEKTA]
A. E. Voitenko et al Apr. 1971 50 p refs Transl. into ENGLISH from Russian report Sponsored by AEC
(UCRL-Trans-10532; IYAF-14-70) Avail: NTIS

A review is presented of the theoretical gas dynamics for and magnetic field effects on gradient acceleration calculations for shock waves. An analysis is given of possible experiments designed to produce velocities of 10 to the 8th power cm/sec and more utilizing the gradient acceleration technique. J.M.

N71-34282# Los Alamos Scientific Lab., N. Mex.
FLASH X-RAY OBSERVATION OF THE FLOW BEHIND A DETONATION WAVE
W. C. Rivard and Douglas Venable Jun. 1970 40 p refs
(Contract W-7405-eng-36)
(LA-4426) Avail: NTIS

The flow field behind a plane detonation wave in Composition B-3 is examined by radiographically observing the motion of metal foils placed between slabs of explosive. The motion of the foils is observed along the centerline of the explosive-foil sandwich by a sequence of radiographs over a range of 5 to 10 centimeters of run. The final position of each foil as a function of its initial position and time is sufficient to determine the density, particle velocity, pressure, and internal energy with no a priori assumption of the equation of state. The data demonstrate to a very good approximation that the flow following the detonation wave is self-similar. The density distribution between the detonation front and the plane wave initiator is determined to within 0.01 grams per cubic centimeter and the pressure distribution to within 4 kbar. Author

N71-34283*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
TURBULENT MIXING OF COAXIAL COMPRESSIBLE HYDROGEN-AIR JETS
James M. Eggers Washington Sep. 1971 58 p refs
(NASA-TN-D-6487; L-7901) Avail: NTIS CSCL 20D

An experimental and analytical study of the compressible turbulent mixing of parallel coaxial hydrogen-air jets has been conducted. Data were acquired for outer air jet Mach numbers of 1.32 and 2.50. The inner hydrogen jet Mach number was approximately 0.9 for both air jet Mach numbers. Experimental hydrogen mass fraction profiles and velocity profiles were determined throughout the near-field and far-field mixing regions. The validity of different eddy viscosity models was studied by incorporating them into an analysis and attempting to compute the present hydrogen-air data and previous air-air data. A kinematic formulation of eddy viscosity which provides radial as well as axial variation in dynamic eddy viscosity, through incorporation of the local density, is essential in order to compute both hydrogen-air and air-air mixing data. Author

N71-34284*# Southwest Research Inst., San Antonio, Tex.
ENGINEERING STUDY OF FLEXIBLE BAFFLES FOR SLOSH SUPPRESSION
Franklin T. Dodge Washington NASA Sep. 1971 22 p refs
(Contract NAS1-10074)
(NASA-CR-1880) Avail: NTIS CSCL 20D

An engineering analysis and design study was conducted to determine if the potential of flexible baffles for providing high damping per unit weight could be realized under operating conditions in a flight system. The elastic properties of aluminum and a large number of non-metallics were determined at 20 C and -196 C, and those materials having the best combination of elastic properties and reaction insensitivity in liquid oxygen were identified. A design procedure was formulated, with the structural strength of the baffle being estimated by a membrane stress analysis. The weight of a flexible baffle system, including the supporting structure, was shown to be substantially less than that of the equivalent rigid baffle system. Model tests of three flexible baffles were conducted in a 30 in. diameter tank. Liquid nitrogen was used as the slosh liquid. The tests simulated the 100 reuse cycle of the proposed space shuttle. Results of the test program verified the design procedures. Author

N71-34285# Syracuse Univ., N.Y. Dept. of Chemical Engineering and Metallurgy.
PIPELINE FLOW OF SOLIDS-LIQUID SUSPENSIONS Final Report
Raffi Turian, Tran-Fu Yuan, and Giacomo Mauri Jul. 1970 p refs
(Grant FWPCA-17070-DUQ)
(PB-199708; W71-08397) Avail: NTIS CSCL 20D

Suspensions containing closely sized beads of varying diameters, made from two types of glass, were allowed to flow through 2, 1 and 1/2 inch pipelines. Available slurry flow data in 1/2 inch pipe using glass, steel, and lead particles were combined with these data, resulting in a particle size range of from 31 microns up to 4380 microns. There were 12 particle sizes, and particle densities of 2.3, 3.0, 4.4, 7.5 and 11.3 gm/cc, with the entire data set consisting of 1511 points. From these data points, a slurry flow correlation was developed which predicts the slurry friction factor. Author (GRA)

N71-34286# Michigan Univ., Ann Arbor. Cavitation and Multiphase Flow Lab.
BUBBLE COLLAPSE ADJACENT TO A RIGID WALL, A FLEXIBLE WALL AND A SECOND BUBBLE
E. E. Timm and F. G. Hammitt Jan. 1971 4 p refs
(Grant NSF GK-13081)
(PB-199464; UMICH-03371-8-INT) Avail: NTIS CSCL 20D

Some preliminary results are presented of high speed motion picture sequences taken of single bubbles collapsing close to a rigid boundary, a flexible boundary, and a second bubble. All are in a beaker containing room temperature tap water. Author (GRA)

N71-34287 National Lending Library for Science and Technology, Boston Spa (England).
USE OF WIND DATA IN THE OBJECTIVE ANALYSIS OF THE UPPER PRESSURE FIELD BY MEANS OF THE METHOD OF OPTIMAL INTERPOLATION
I. Kluge [1971] 21 p refs Transl. into ENGLISH from Glav. Geof. Obs., T. Vyp. (Leningrad) no. 267, 1970 p 32-51
(NLL-M-20698-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The objective analysis of meteorological fields in sparse meteorological networks is discussed. The analysis consists of using wind data, based on statistical relationships, as additional information in the interpolation of geopotential heights at grid points. E.H.W.

N71-34288 National Lending Library for Science and Technology, Boston Spa (England).
DEVELOPING FLOW IN CHANNELS OF VARYING CROSS-SECTIONS
Martin Fiebig 2 Mar. 1971 23 p refs Transl. into ENGLISH from Z. Flugwiss. (West Germany), v. 18, no. 2/3, 1970 p 84-92 in ENGLISH and GERMAN
(NLL-M-20369-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The method to calculate the hydrodynamic entrance length in channels of constant cross section is extended to all the calculation of hydrodynamic entrances in channels of varying cross sections. For this extension a different physical interpretation of the mathematical simplifications is necessary.

The method is restricted to cross section variations for which asymptotically a fully developed flow exists. Velocity and pressure distributions are given for two dimensional channels and tubes for different cross section variations. Author

N71-34289 Tennessee Univ., Knoxville.
VISCOELASTIC ENTRANCE FLOWS: MODELS FOR PRESSURE DROP AND FLOW INSTABILITIES
James Oswald Casey, Jr. (Ph.D. Thesis) 1969 183 p
Avail: Univ. Microfilms Order No. 70-17803

Two facets of viscoelastic entrance flow were studied: (1) the total entrance pressure loss and (2) the onset of flow instability. In the portion of the work dealing with the entrance pressure loss, a macroscopic mechanical energy balance was derived for viscoelastic fluids and subsequently applied to the viscoelastic entrance problem. It was found that the general engineering Bernoulli balance must be modified by addition of terms accounting for the work of normal stresses at the inlet and outlet and by a term accounting for elastic energy effects. For isothermal flow, elastic energy effects can be represented by changes in the Helmholtz free energy, while for nonisothermal flow a new material function must be introduced. Dissert. Abstr.

N71-34290 California Univ., Berkeley.
STRATIFIED FLOW INTO A CONTRACTION
Harvey L. Segur (Ph.D. Thesis) 1969 177 p
Avail: Univ. Microfilms Order No. 70-17651

The effects of vertical contraction on the horizontal flow of an inviscid, incompressible, density-stratified fluid are examined. The flow of a homogenous fluid with a free surface over a small step and the flow of two layers of homogeneous fluid, with a common interface, into a weak contraction are examined. The geometric disturbance is created impulsively, and the resulting flow is determined in the limit of large time. The steady flow of a continuously stratified fluid into an arbitrarily strong contraction also is considered. In either linearized problem, no transient wave can travel upstream to block any supercritical flow. In the continuous-stratification problem, a criterion which is both necessary and sufficient for the existence of solutions to the Helmholtz equation is derived. Non existence of solutions is associated with blocked flows experimentally. Dissert. Abstr.

N71-34291 Stanford Univ., Calif.
NUMERICAL SOLUTIONS FOR TIME DEPENDENT, VISCOUS, INCOMPRESSIBLE FLUID FLOW PAST A CIRCLE
Stanley Kenton Jordon (Ph.D. Thesis) 1970 105 p
Avail: Univ. Microfilms Order No. 70-18423

A method is described for solving time-dependent, viscous, incompressible fluid flow past a circle when the free stream is either uniform or nonuniform and the circle is either stationary, moving in a prescribed manner, or moving under the action of fluid dynamic forces (drag, lift, and torque) and body forces (gravity). By describing the fluid motion from the point of view of an observer fixed to the center of the circle, and by using the vorticity and a stream function as dependent variables, the complications which normally arise when using a non-inertial reference frame are removed from the differential equations which describe the motion of the fluid. It is possible to employ the same algorithm in solving for the flow past a fixed or freely supported circle. Dissert. Abstr.

N71-34292 California Inst. of Tech., Pasadena.
STEP INDUCED SEPARATION OF A TURBULENT BOUNDARY LAYER. PART 1: EXPERIMENTS IN SUPERSONIC FLOW. PART 2: A MODEL FOR INCOMPRESSIBLE FLOW IN A CHANNEL
Robert Lee Gran (Ph.D Thesis) 1970 187 p
Avail: Univ. Microfilms Order No. 70-18036

The separation of a two-dimensional turbulent boundary layer caused by a forward facing step is investigated. The two major flow regimes considered are in the realms of supersonic flow and incompressible flow in a channel. For the case of supersonic turbulent boundary layer separation, a series of experiments were conducted. The upstream pressure field for step sizes in the range from 5% to 150% of the local boundary layer thickness was determined and correlated with large step data. The separated shear layer was found to be approaching a constant pressure and self-similar flow in a distance of a round 6-10 initial boundary layer thicknesses. Fluctuation measure ments were conducted near the similar flow region. For the incompressible flow over a step in a channel, an inviscid model utilizing free streamline theory and based on experimental observations was constructed and solved with the aim of predicting the upstream flow field. Dissert. Abstr.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-34293*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
TIDAL THEORY AND ORBITAL PERTURBATIONS Final Report
William M. Kaula and M. Alan Joncich Jun. 1971 109 p refs
(Grant NGR-05-007-138)
(NASA-CR-121641) Avail: NTIS CSCL 08C

The work in linking ocean tides to satellite orbits is reported. Topics discussed include: Laplace tidal equations, perturbation method, dissipative model, reduction in terms of tide height, and tidal perturbations. F.O.S.

N71-34294*# Indiana Univ. Foundation, Bloomington. Aerospace Research Applications Center.
CHALLENGE: THE ENVIRONMENT Conference Proceedings
William B. DeVille, ed. 1970 117 p refs Conf. on Problem-Oriented Approaches to the Environ. by Govt., Ind., Banking, Conserv., and Law held in Bloomington, Ind., 29-30 Oct. 1970
(Contract NASw-2171)
(NASA-CR-121637) Avail: NTIS CSCL 13B

Edited transcripts of the speeches made at the Conference on the Environmental Challenge are presented. The conference was organized by the Environmental Systems Applications Center (ESAC), a division of the Aerospace Research Applications Center (ARAC), for a better understanding of the role of information in the national goal to achieve and protect a livable environment. Topics discussed included: the role of the Council on Environmental Quality, pollution control and the diesel engine, the role of the courts in environmental decision making, and the Chase Manhattan Bank environmental systems group. Transcripts of the group sessions and a brief discussion of the missions of the ESAC were also included. J.G.M.

N71-34295*# Research Triangle Inst., Durham, N.C. Engineering and Environment Sciences Div.
APPLICATIONS OF AEROSPACE TECHNOLOGY IN AIR POLLUTION CONTROL Semiannual Report, 30 Sep. 1970 31 Mar. 1971
1971 80 p refs
(Contract NASw-1950)
(NASA-CR-121636; RTI-EU-564) Avail: NTIS CSCL 13B

The research and development activities directed toward the application of aerospace technology to public sector problems are described. Significant applications were made in wind tunnel design criteria, working fluids for Rankine cycle engines, and problems of air pollution control. In addition, two technology transfers in the marine sciences area are reported. E.H.W.

N71-34296*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
REVISED STATIC MODELS OF THE THERMOSPHERE AND EXOSPHERE WITH EMPIRICAL TEMPERATURE PROFILES
L. G. Jacchia 5 May 1971 121 p refs
(Grant NGR-09-015-002)
(SOA-SR-332; SAO-103-38) Avail: NTIS CSCL 04A

Tables showing temperature, density, and composition as a function of height are given for exospheric temperatures ranging from 500 deg to 1900 deg at 100 deg K intervals and for heights from 90 to 2500 km. A set of auxiliary tables is provided to help in the evaluation of the diurnal, geomagnetic, semiannual, and seasonal-latitudinal effects (including the helium migration). Author

N71-34297*# California Univ., Los Angeles. Inst. of Geophysics and Space Physics.
NATURE AND CHANGES OF ORGANIC MATTER IN DEEP OCEAN CORES Annual Progress Report, 1 Jul. 1970 - 1 Apr. 1971
1 Apr. 1971 27 p refs
(Grant NGR-05-007-221)
(NASA-CR-121734; APR-2) Avail: NTIS CSCL 08A

The sediment from five deep sea cores were examined, representing fifteen individual samples. Some of the sediment was typical of normal deep sea clays, low in organic matter, whereas others were richer and approached more closely near shore environments. Two cores originated in the Gulf of Mexico, and the influence of upward migration of petroleum could be noticed from the unusually high hydrocarbon values. The cores of others came from the Atlantic Ocean. The samples represent an age spread from Pleistocene to Eocene. The studies were performed to separate, identify, and quantitatively determine the following organic components: (1) hydrocarbons, (2) fatty acids, (3) alcohols, and (4) chlorins and porphyrins. The data obtained are presented in tables and the techniques used for removal, detection, and estimation are given. D.L.G.

N71-34298*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
FIELD LINE MOTION DURING GEOMAGNETIC STORMS
Andrei Konradi, Jiann-Tsorng Horng (New Hampshire Univ., Durham), and Richard L. Kaufmann (New Hampshire Univ., Durham) 1971 57 p refs
(Grant NSF GA-14954)
(NASA-TM-X-67295) Avail: NTIS CSCL 04A

It was found, during two intense substorms, that the high-latitude trapping boundary for 20-kev electrons and 100-kev protons becomes very thin in the early morning hours. The gradients are too steep to be maintained by drifting particles, so they must be produced locally over the night side of the earth. The flux gradient is seen to move at speeds in excess of 100 km/sec. Plasma appears to move away from the tail and around the earth at these high speeds during the sudden expansion phases of the substorms. The rapid plasma motion requires the presence of 50 to 100 mV/m electric fields at a geomagnetic latitude of 30 deg on the L = 5 field line. The observations fit best into a model that contains two field-aligned sheet currents. Current flows downwards toward the ionosphere at or beyond the poleward edge of the disturbance, and away from the earth at lower latitudes. Author

N71-34299*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ELF NOISE BANDS ASSOCIATED WITH AURORAL ARCS
D. A. Gurnett and L. A. Frank Jul. 1971 20 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-8144; NAS1-8150; Grant NGL-16-0-01-043; et al)
(NASA-CR-121676; Rept-71-28) Avail: NTIS CSCL 03B

Observations of a type of ELF noise band which is closely associated with low-energy electron precipitation events and auroral arcs are reported. The observations were made at relatively low altitudes (<3000 km) with the polar orbiting satellite Injun 5. The noise bands typically have a center frequency of from 100 to 300 Hz and often appear to consist of many nearly monochromatic bursts, typically of a few seconds duration, superimposed to give the observed spectrum of the emission. These ELF noise bands were only observed in a relatively narrow latitudinal region in the auroral zone. It is noted that the spectral characteristics of this noise are very similar to a type of narrow-band magnetic noise called lion's roar which was observed at much higher altitudes in the magnetosheath with the satellite OGO-5. It is suggested that the ELF noise bands observed are produced by lion's roar emissions which have propagated down open magnetic field lines from the magnetosheath region to the Injun 5 altitude. Author

N71-34300*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
CORRELATED SATELLITE MEASUREMENTS OF LOW-ENERGY ELECTRON PRECIPITATION AND GROUND BASED OBSERVATIONS OF A VISIBLE AURORAL ARC
K. L. Ackerson and L. A. Frank Jul. 1971 28 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-2973; Grant NGL-16-001-002; Contract N00014-68-A-0196-003)
(NASA-CR-121675; Rept-71-23) Avail: NTIS CSCL 03B

A comparison of low-energy charged particle intensities measured with the low-altitude satellite Injun 5 and a ground-based observation of an auroral arc at Fort Churchill on 21 December 1966 during late local evening has established that an intense precipitation band of electron intensities provides the primary energy influx for the auroral light. This precipitation event was located poleward of and adjacent to the trapping boundary for more energetic electron intensities. The peak energy fluxes were directed along the local magnetic field direction into the earth's atmosphere. Proton and electron intensities similar to those in the plasma sheet in the magnetotail were observed in a substantially less intense zone positioned equatorward of and adjacent to the trapping boundary. Angular distributions of these particle intensities from the plasma sheet were peaked at pitch angles perpendicular to the local magnetic field. Author

N71-34301*# Pittsburgh Univ., Pa. Dept. of Physics.
DEACTIVATION OF N2A 3 SIGMA u PLUS MOLECULES IN THE AURORA
D. E. Shemansky, E. C. Zipf, and T. M. Donahue Aug. 1971 p refs
(Grants NGR-39-011-002; NSF GA-1237; NSF GA-18224; Contract DA-31-124-ARO(D)-440)
(NASA-CR-121671; SRCC-157) Avail: NTIS CSCL 04A

Rocket observations of the N2V-K (Vegard Kaplan) system in the aurora were reinterpreted using an atmospheric model based on mass spectrometer measurements in an aurora of similar intensity at the same time of year. In contrast to the original interpretation, it was found that population by cascade from the C 3 Pi u and B 3 Pi g states in the A 3 Sigma u + v = 0,1 levels, as calculated using measured electron excitation cross sections, accurately accounts for the observed relative emission rates. In addition there is no need to change the production rate of A 3 Sigma u + molecules relative to that of C 3 Pi u v = 0 as a function of altitude in order to fit the profile of the deactivation probability to the atmospheric model. Quenching of A 3 Sigma u + molecules at high altitudes is dominated by atomic oxygen. The rate constants for the v = 0 and v = 1 levels are 8 x 10 to the minus 11th power cu cm/sec and 1.7 x 10 to the minus 10th power cu cm/sec respectively, as determined using the model atmosphere mentioned above. Author

N71-34302*# Bellcomm, Inc., Washington, D.C.
CALCULATION OF THE THERMODYNAMIC STATE OF A THREE-DIMENSIONAL ATMOSPHERE
I. O. Bohachevsky and I. J. Eberstein (NASA - Goddard Space Flight Center) 16 Aug. 1971 54 p refs

(Contract NASw-417)
(NASA-CR-121745; TM-71-1031-3) Avail: NTIS CSCL 04A

Computations carried out for a massive Venus-like atmosphere establish the feasibility of performing three-dimensional calculations of radiative effects. Preliminary observations of the results show that: a) longitudinal and latitudinal pressure variations are substantial; b) pressure and temperature distributions are nonsymmetric with uniform values throughout the dark hemisphere; and c) radiative-conductive relaxation time is comparable to Venusian rotation period. These findings indicate that a realistic treatment of the Venusian atmosphere should contain global circulation because of asymmetry the circulation pattern will not be approximated by a planar two-dimensional model and the analysis should include the effect of planetary rotation. Parametric studies with a one-dimensional version of the program demonstrate the possiblity of approximating realistic temperature profiles with a two-band model. Author

N71-34303*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE UPPER ATMOSPHERE AS A REGULATOR OF SUBAURORAL RED ARCS
S. Chandra, E. J. Maier, and P. Stubbe (Max-Planck-Inst. fur Aeronomie) Aug. 1971 28 p refs Submitted for publication
(NASA-TM-X-65680; X-621-71-325) Avail: NTIS CSCL 03B

The mechanisms for producing a subauroral red arc (SARARC) were studied by solving a system of basic ionospheric and atmospheric equations. It is shown that many of the observed features of a SARARC can be explained within the framework of the two processes generally responsible for the ionospheric behavior during a magnetic storm: These are (1) energy conduction from the magnetosphere to the ionosphere and (2) the changes in neutral composition of the lower atmosphere caused by the increase in turbulent mixing. Both processes trigger a complex chain of events which ultimately results in the redistribution of both the charged and neutral particles; an increase in the electron, ion, and neutral temperatures; and a decrease in the electron density in the altitude region near the F-2 peak. It is shown that both the occurrence and the emission intensity of a SARARC are regulated by the neutral atmosphere, eventhough conduction of the thermal energy from the magnetosphere to the ionosphere provides the excitation energy for the optical emission. Satellite measurements of the ionospheric parameters confirmed the validity of these findings and provided grounds for rejecting several other theories. Author

N71-34304*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Aero-Astrodynamics Lab.
ATMOSPHERIC DENSITY VARIATIONS AT 140 km DEDUCED FROM PRECISE SATELLITE RADAR TRACK ING DATA
Leonard L. De Vries, Leonard Schusterman (Aerospace Corp., El Segundo, Calif.), and Richard W. Bruce (Aerospace Corp., El Segundo, Calif.) 24 Aug. 1971 18 p refs
(NASA-TM-X-64610) Avail: NTIS CSCL 04A

The technique of evaluating density values from precise radar tracking data of satellites in the altitude region 130 to 140 km is discussed. Inclinations of these satellites were between 106 and 112 degrees. All elements of the density reduction technique were examined in detail, with consideration given to recent advances in geodesy, drag coefficient modeling, and orbit determination techniques. Ten days of high resolution density data deduced from orbital decay of each of three satellites are presented. Three types of density variations at 140 km are discernible in these data: (1) periodic daily density variations with a density amplitude of about 10 percent; (2) density increases of up to 35 percent associated with enhanced geomagnetic activity during which the planetary geomagnetic index reached a value of eight units; and (3) an observed semiannual variation of about 20 percent, which indicates a total semiannual variation of 35-40 percent. These variations are discussed and compared with other results. Author

N71-34305*# Purdue Univ., Lafayette, Ind. Lab. of Agricultural Remote Sensing.
REMOTE MULTISPECTRAL SENSING IN AGRICULTURE, VOLUME 1, NO. 4
[1971] 150 p Original Contains Color Illustrations
(NASA Order W-12996)
(NASA-CR-121769) Avail: NTIS CSCL 02C

Developments in the detection, identification, and mapping of various vegetation and soil features utilizing multispectral scanner systems and automatic data handling and processing techniques are summarized. The concept, design, calibration, and operation of instruments for the remote measurement of observable physical agricultural features are reported. Data processing methods for multispectral remote sensing in agriculture and agricultural requirements and potential applications of remote sensing are included as well as the plans for agricultural experiments in earth resources aerospace programs. J.M.

N71-34306# National Research Council of Canada, Ottawa (Ontario).
STATISTICAL PROPERTIES OF THE HELIUM EMISSION [STATISTICHESKIE SVOISTVA GELIEVOI EMISSII]
N. N. Shefov 1971 8 p refs Transl. into ENGLISH from the publ. "Polyarnye Siyaniya i Svechenie Nochnogo Neba. Sbornik Statei (13): Seriya 'Rezultaty MGG'" Moscow , Izd. Akad. Nauk SSSR, 1966 p 64-68
(NRC-TT-1458) Avail: NTIS

Statistical treatment of observational data of helium emission indicates considerable variations in the ultraviolet radiation of the sun during the solar cycle and over a period of 27 days. A relationship is established between electron fluxes of about 25 ev and magnetic activity. Author

N71-34307# National Research Council of Canada, Ottawa (Ontario).
AN ATTEMPT TO DETECT CHARACTERISTIC ATMOSPHERIC EMISSIONS DURING THE SOLAR ECLIPSE OF 15 FEBRUARY 1961 [POPYTKA OBNARUZHENIYA SOBSTVENNYKH EMISSI ATMOSFERY VO VREMYA SOLNECHNOGO ZATEMIYA 15 FEVERALYA 1961 G]
F. K. Shuiskaya 1971 20 p refs Transl. into ENGLISH from the publ. "Polyarnye Siyaniya i Svechenie Nochnogo Neba. Sbornik Statei (10): Seriya 'Rezultaty MGG'" Moscow, Izd. Akad. Nauk SSSR, 1963 p 44-53
(NRC-TT-1459) Avail: NTIS

During the full phase of a solar eclipse, spectrographic observations were conducted from an aircraft to study upper atmosphere radiation. The He I 10830, (OI) 6300, Na I 5896 and 5890, and O I 4368 A emissions were recorded and their intensities estimated. Author

N71-34308# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC DATA, JUNE 1969
Jun. 1969 79 p
(RTRC-A169) Avail: NTIS

Tables of recorded hourly values of ionospheric propagation characteristics are presented for several areas in India for June 1969. Author

N71-34309# National Physical Lab., New Delhi (India). Radio Science Div.
IONOSPHERIC DATA, JULY 1969
Jul. 1969 67 p
(RTRC-A170) Avail: NTIS

Tables of recorded hourly values of ionospheric propagation characteristics are presented for several areas in India for July 1969. Author

N71-34310# National Research Council of Canada, Ottawa (Ontario).
DIURNAL VARIATIONS OF THE HELIUM EMISSION [O SUTOCHNYKH VARIATSIYAKH EMISSI GELIYA]
O. G. Teranova 1971 7 p refs Trans. into ENGLISH from the publ. "Polyarnye Siyaniya i Svechenie Nochnogo Neba. Sbornik Statei (13): Seriya 'Rezultaty MGG'", Moscow, Izd. Akad. Nauk SSSR, 1966 p 50-52
(NRC-TT-1457) Avail: NTIS

A description is given of the reduction method of spectrophotoelectric observations of the twilight helium emission. Experimental data are also given. Author

N71-34311# California Univ., La Jolla. Scripps Institution of Oceanography.
PRECISION DEEP SEA TIME RELEASE
Meredith H. Sessions and Phillip M. Marshall 3 Mar. 1971 p refs
(Contracts AT(04-3)-34; N00014-69-A-0200-6006)
(UCSD-34-p-127-8; SIO-71-5) Avail: NTIS

A family of oceanographic instrument systems that descend freely to the ocean floor, to return later to the surface, are now in use. Vital to the free vehicle instrument system is a reliable and accurate programmable anchor release device. A release device capable of being easily programmed in one hour increments to a total of 1000 hours is described, including results of test and field evaluation. Author

N71-34312# Oregon State Univ., Corvallis. Dept. of Oceanography.
SOUND SCATTERING LAYERS OFF THE OREGON COAST
Henry A. Donaldson and William G. Pearcy [1971] 15 p refs
(Contract AT(45-1)1750; Grants NSF GB-1588; NSF GB-5494)
(RLO-1750-62) Avail: NTIS

Temporal and spatial variations in the depth, thickness, and vertical movement of scattering layers were studied using a 38.5 kHz echosounder. Usually one or two layers migrated toward the surface at dusk and descended into deeper water at dawn. Reflectors migrated between the upper scattering layer and the surface during twilight periods. Individual scattering layers migrated at a fairly constant rate during a twilight period, but rates of ascent and descent varied from day to day. The thickness of the scattering layers was usually greater during night than day. It was greater over the continental slope than abyssal depths, and in some years it was greater during the summer than during other seasons. On a cruise between Hawaii and Adak, Alaska, central waters had large amounts of scattering but low midwater trawl catches, transitional waters had high intensity scattering layers and high biomass, and subarctic waters had very reduced scattering layers but high biomass.
Author

N71-34313# Joint Publications Research Service, Washington, D.C.
EQUIPMENT AND METHODS FOR MARINE MEASUREMENT OF THE FORCE OF GRAVITY
Yu. D. Sulanzhe, ed. 18 Aug. 1971 128 p refs Transl. into ENGLISH from 'Apparatura i Metody Izmereniya Sily Tyazhesti na More' Moscow, Nauka, 8 Dec. 1970 p 40-57, 67-85, 93-153
(JPRS-53851) Avail: NTIS

CONTENTS:

1. FREQUENCY ANALYSIS OF PERTURBATION ON BOARD A SUBMARINE L. A. Belobzheskiy p 1-12 (See N71-34314 21-13)

2. EXPERIMENTAL ESTIMATE OF RANDOM ERRORS IN GRAVITY MEASUREMENTS MADE ON BOARD A SUBMARINE M. G. Kogan p 13-23 (See N71-34315 21-13)

3. EVALUATION OF DISTURBING ACCELERATIONS AND TILTS ON THE READINGS OF A GYROSTABILIZED MARINE GRAVIMETER V. S. Kutepov p 24-40 (See N71-34316 21-14)

4. A MARINE GRAVIMETER WITH A CODING DEVICE V. A. Tulin p 41-48 (See N71-34317 21-14)

5. A MARINE GRAVIMETER WITH AUTOMATIC READOUT V. A. Tulin p 49-59 (See N71-34318 21-14)

6. INVESTIGATION OF THE ACCURACY OF THE GAL-OMPO-2 GRAVIMETER V. A. Tulin p 60-75 (See N71-34319 21-14)

7. THE RUG INSTRUMENT FOR RECORDING ACCELERATIONS AND TILTS Ye. I. Popov p 76-84 (See N71-34320 21-14)

8. GYROSTABILIZED PLATFORMS FOR STABILIZATION OF GRAVIMETERS AND THEIR EXPERIMENTAL TESTING V. K. Karpov p 85-103 (See N71-34321 21-14)

9. INVESTIGATION OF THE DYNAMICS OF GYROSTABILIZED PLATFORMS WITH PENDULUM CORRECTION, INTENDED FOR THE STABILIZATION OF GRAVIMETERIC APPARATUS V. K. Karpov p 104-118 (See N71-34322 21-14)

10. SOME RESULTS OF AN INVESTIGATION OF GYROSTABILIZED PLATFORMS V. S. Kutepov p 119-126 (See N71-34323 21-14)

N71-34314# Joint Publications Research Service, Washington, D.C.
FREQUENCY ANALYSIS OF PERTURBATION ON BOARD A SUBMARINE
L. A. Belobzheskiy et al *In its* Equipment and Methods for Marine Meas. of the force of Gravity 18 Aug. 1971 p 1-12 refs (See N71-34313 21-13)
Avail: NTIS

A simple method is described for spectral analysis of the results of gravimetric observations onboard a submarine, so that nominal requirements for averaging time length could be found in every specific instance. The method utilizes an analog computer which permits the direct computation of data recorded as curves on paper tape or movie film, automatic input of data into the computing unit, and the obtaining of computational results in the form of a graph on diagrammatic tape. The reliability of the operation was tested by analyzing two types of oscillograms. Results are presented of tests conducted on submarine perturbations obtained from automated gravimeters.
A.L.

N71-34315# Joint Publications Research Service, Washington, D.C.
EXPERIMENTAL ESTIMATE OF RANDOM ERRORS IN GRAVITY MEASUREMENTS MADE ON BOARD A SUBMARINE
M. G. Kogan *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 13-23 refs (See N71-34313 21-13)
Avail: NTIS

Utilizing a grapho-mechanical analyzer, 29 recordings made onboard submarines were analyzed. The recordings were chosen at random from those obtained on each of five working days. Results obtained were: (1) The recording spectrum of the GAL-P marine gravimeter onboard a submarine was obtained. (2) The averaging error of the recording of a 24 minute interval of observations is + or - 1.3 milligals; for a 12 minute interval, it is + or - 2.7 milligals, if perturbations are considered only in range of frequencies for which spectrum was constructed. (3) The influence of perturbations connected with wave action on the sea's surface is negligibly small. (4) The spectrum of vertical accelerations, operating on a gravimeter installed on a universal joint was constructed and the average quadratic value of the accelerations was + or - 72 milligals. (5) Those frequency analysis errors connected with errors in the surveying and orientation of the recordings are negligibly small.
A.L.

N71-34316# Joint Publications Research Service, Washington, D.C.
EVALUATION OF DISTURBING ACCELERATIONS AND

TILTS ON THE READINGS OF A GYROSTABILIZED MARINE GRAVIMETER c14

V. S. Kutepov et al *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 24-40 refs (See N71-34313 21-13)

Avail: NTIS

A gravimetric measuring device was developed consisting of: an altered aerial photographic survey gyromounting, gravimeter, horizon and acceleration recorder, control instrument, and a time marker. Experimental tests were conducted in an effort to verify the theory of marine gravimetric determinations and to obtain the characteristics of the background of disturbing accelerations during observations onboard submarines. Results of the laboratory and sea tests are presented in tabular and graphical form. A.L.

N71-34317# Joint Publications Research Service, Washington, D.C.

A MARINE GRAVIMETER WITH A CODING DEVICE c14

V. A. Tulin *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 41-48 refs (See N71-34313 21-13)

Avail: NTIS

An optical-mechanical mechanism for numerical pulse coding of a gravimeter's signal was developed for the purpose of ensuring automatic averaging of the recording's variable sign component. Results of field testing of the GAL-P gravimeter in conjunction with this device are presented. The tests were conducted aboard submarines operating in the Black Sea. Tests showed that this autonomous device guarantees measurement accuracy up to + or - 1.5 to 2.0 milligals. This value is close to the optimum, since it is fully commensurable with observational errors onboard a submarine, which arise because of the presence of long period, variable sign accelerations. A.L.

N71-34318# Joint Publications Research Service, Washington, D.C.

A MARINE GRAVIMETER WITH AUTOMATIC READOUT c14

V. A. Tulin et al *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 49-59 refs (See N71-34313 21-13)

Avail: NTIS

As a result of the laboratory and sea tests of the first model of the gravimeter with optical-mechanical readout transformer, the possibility of finding a method for automated sea observations was established. Along with this, some flaws in the equipment construction was discovered, and a method for eliminating them was planned. Solutions to the following problems are discussed: (1) extending range of gravimeter; (2) achieving linearity of the scale division; (3) accomplishment of transfer to a double elastic system; (4) guarantee of maximum convenience in adjusting the optical system and decrease in size and weight; and (5) improvement of universal joint for operations onboard a submarine. A.L.

N71-34319# Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF THE ACCURACY OF THE GAL-OMPO-2 GRAVIMETER c14

V. A. Tulin et al *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 60-75 refs (See N71-34313 21-13)

Avail: NTIS

Facts ascertained as a result of the laboratory and field tests of double system, automated, marine gravimeters with a range of 12-20 gals are: (1) scale division of gravimeters changes linearly, in the 0-2400 milligal range; (2) in the 0-35 gal range, within the limits of observational error, vertical accelerations do not cause systematic effects; acceleration magnitude of horizontal accelerations in same range are -1.5 + or - 0.6 milligals; (3) random observational error on surface ship is + or -2.8 milligals, with accelerations of 10-40 gals and periods of 2-4 seconds; (4) random observational error on submarines is + or - 2.3 milligals; (5) displacement of gravimeter's zero point is linear and average value is 4-5 milligals per day; (6) gravimeters's readout accuracy is + or - 0.8-1.1 milligals, with a sensitivity threshold of + or - 0.25-0.36 milligals; and (7) the gravimeter does not react to voltage changes, within limits of + or - 5%. A.L.

N71-34320# Joint Publications Research Service, Washington, D.C.

THE RUG INSTRUMENT FOR RECORDING ACCELERATIONS AND TILTS c14

Ye. I. Popov et al *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 76-84 (See N71-34313 21-13)

Avail: NTIS

The design characteristics and operation of the horizon and acceleration recorder are described. The principal feature of the instrument is synchronous recording of perturbing acceleration and residual tilts on one film. The recorder consists of the following basic parts: a body with a geared tape driving mechanism, an accelerometer unit, a horizon photorecording unit, changeable film cassettes, and a portable control panel. A.L.

N71-34321# Joint Publications Research Service, Washington, D.C.

GYROSTABILIZED PLATFORMS FOR STABILIZATION OF GRAVIMETERS AND THEIR EXPERIMENTAL TESTING c14

V. K. Karpov *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 85-103 refs (See N71-34313 21-13)

Avail: NTIS

Designs were developed for the Horizon and Horizon-M power gyrostabilized platforms for use in stabilizing the GAL gravimeter and the horizon and acceleration photorecorder. A method was developed for laboratory testing of the gyrostabilizer were conducted with the following results: (1) the horizon platform and results are presented. Sea tests of the gyrostabilizer showed its suitability for stabilizing gravimetric apparatus; and (2) the dynamic operational accuracy of the gyroplatform was determined in accordance with list and trim differences of 2.6 minutes of angle and 2.1 minutes of angle, respectively. A.L.

N71-34322# Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF THE DYNAMICS OF GYROSTABILIZED PLATFORMS WITH PENDULUM CORRECTION, INTENDED FOR THE STABILIZATION OF GRAVIMETRIC APPARATUS c14

V. K. Karpov et al *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 104-118 refs (See N71-34313 21-13)

Avail: NTIS

A mathematical description of a gyrostabilizer (GS) with pendulum correction was proposed that permitted the conduct of theoretical tests of the dynamic accuracy of the GS's when they are perturbed by linear harmonic acceleration, and to more fully allow for peculiarities in the correction circuit. The analytical solution of the proposed GS equations permitted analysis of the influence of a number of factors on the dynamic stabilization accuracy. Results of mathematical modeling confirmed the basic conclusions of the analytical tests of the GS's dynamic accuracy and, with a sufficient degree of accuracy, coincide with the results of full-scale tests of the Horizon gyrostabilized platform conducted under laboratory and sea conditions. A.L.

N71-34323# Joint Publications Research Service, Washington, D.C.

SOME RESULTS OF AN INVESTIGATION OF GYROSTABILIZED PLATFORMS c14

V. S. Kutepov *In its* Equipment and Methods for Marine Meas.

of the Force of Gravity 18 Aug. 1971 p 119-126 refs (See N71-34313 21-13)
Avail: NTIS

Laboratory tests were conducted to determine stabilization errors, as a function of perturbation magnitude and character, on a gyrostabilized platform for gravimetric equipment. Results of the tests indicated: (1) when gyrostabilizers are used for gravimetric observations on surface ships which are rolling with a period of 20-30 seconds, stabilization accuracy should be controlled, since the platform errors exceed 5 feet under accelerations up to 10 gals. (2) The stabilizer has the most advantageous phase relationship between platform tilts and horizontal accelerations. (3) Preliminary evaluations can be made of possible dynamic errors of the gravimeter due to tilts and accelerations. (4) Static errors, arising from the insensitivity of the correction system to tilts, should be kept in mind when selecting a gyrostabilizer for gravimetry use. (5) In order to obtain completely accurate characteristics for the gyrostabilizers, additional tests must be made for errors caused by periodically changing base tilts. A.L.

N71-34324*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
A SATELLITE STUDY OF dc ELECTRIC FIELD REVERSALS IN THE MAGNETOSPHERE
David Paul Cauffman (Ph.D. Thesis) May 1971 142 p refs (Contracts NAS5-10625; NAS1-8141; NAS1-8144; NAS1-8150; Grant NGL-16-001-043; et al)
(NASA-CR-121741; Rept-71-15) Avail: NTIS CSCL 03B

The convection electric fields observed with the double-probe type dc electric field experiment on the low altitude polar orbiting Injun 5 satellite are discussed. Simultaneous measurements of antenna impedance by the spacecraft make it possible to investigate in detail the operation of the electric antenna system and errors caused by sunlight shadows on the probes, wake effects, and other factors. Electric field magnitudes as small as + or - 10 mV/meter can be measured under favorable conditions. Reversals in the dc electric field at auroral zone latitudes are the most significant convection electric field effect identified in the Injun 5 data. Electric field magnitudes of typically 30 mV/meter, and sometimes 100 mV/meter, are associated with reversals. Electric field reversals occur on approximately 36% of auroral zone traversals, at about 70 deg to 80 deg invariant latitude, and at all local times. Author

N71-34325# Japan Meteorological Agency, Tokyo.
AEROLOGICAL DATA OF JAPAN, SEPTEMBER 1969. APPENDIX: ROCKET SONDE DATA
1970 302 p
Avail: NTIS HC $6.00/MF $0.95

Monthly upper air data observed in Japan and its vacinity are reported in tabular form. Data include pressure, temperature, humidity, and wind levels. The data are corrected for temperature error due to solar radiation and the effect of low temperature on the vacuum cell, and the curvature of the surface of the earth is taken into account in the computation of upper winds. Rocket sonde data are also given. E.H.W.

N71-34326# Academy of Sciences (USSR), Moscow.
COSMIC DATA: MONTHLY REVIEW NO. 12, DECEMBER 1969
Z. Rapoport, ed. 1970 51 p In RUSSIAN; ENGLISH summary
Avail: NTIS

The results are given of observations of geophysical phenomena connected with the electric and magnetic state of the upper atmosphere (geomagnetic variations, ionosphere, and cosmic rays) as well as data of solar activity. Data are given for December 1969 and the tables of median ionospheric data of Ashkhabad station for May, June, and July 1969 and data for August 1969 of Murmansk are presented. Author

N71-34327# Deutscher Wetterdienst, Hohenpeissenberg (West Germany).
INTERNATIONAL OZONE SONDE INTERCOMPARISON AT THE OBSERVATORY · HOHENPEISSENBERG, 19 JANUARY - 6 FEBRUARY 1970
Walter Attmannspacher and Hans Ulrich Duetsch 1970 86 p refs
(Rept-120) Avail: NTIS

Six different wet chemical ozone sondes were compared based on the results of 41 tandem flights under field conditions. The analyses of these sounding data show that the four ozone sondes, which are presently used in a routine sounding program, produce only minor systematic differences against each other, if a single factor adjustment to the total amount is used. The other instruments, being still in the experimental stage, are somewhat less stable. Author

N71-34328# Joint Publications Research Service, Washington, D.C.
RESULTS OF A COMBINED FULLY-INSTRUMENTED SUBSATELLITE GEOPHYSICAL EXPERIMENT
K. Ya. Kondratyev et al 24 Aug. 1971 7 p refs Transl. into ENGLISH form Dokl. Akad. Nauk SSSR, (Moscow), v. 196, no. 6, 1971 p 1333-1336
(JPRS-53895) Avail: NTIS

Photography and spectrophotometry of the earth's surface along the route Caspian Sea-Ust'-Urt-Aral Sea were provided for the purposes of solving the indicated missions in the program of scientific experiments on the SS Soyuz-6 and Soyuz-7. In order to obtain information on the transmittance function of the atmosphere on the specified route, flights were carried out in LI-2 and IL-18 aircraft with a full set of apparatus, in which devices analogous to those which were installed on the SS were a part. At the same time, a physical-geophysical inventory of the surface along the flight path was conducted by ground crews. A combined experiment with the simultaneous effort of a ground crew, aircraft, and SS was carried out. Some results are reported. Author

N71-34329# Geological Survey, Washington, D.C.
GEOLOGICAL IMPLICATIONS OF AEROMAGNETIC DATA IN THE PEND OREILLE AREA, IDAHO AND MONTANA
Elizabeth R. King, Jack E. Harrison, and Allan B. Griggs 1970 20 p refs Geol. Survey Profess. Paper 646-D
Avail: SOD

An aeromagnetic survey was made to outline intrusive bodies to help provide three-dimensional control for a geochemical study of contact and regional metamorphism. Most of the host rocks are part of the Belt supergroup. Interpretations of the southern 800 square miles of the survey are confined to tectonics and ore deposits. Both exposed and buried Cretaceous granodiorite cupolas and stocks are reflected. Major block faults were reactivated during tectonic swelling and emplacement of the granodiorite. Subsequent collapse created a block mosaic of minor faults within the older blocks. One zone of class high-angle faults was caused by collapse of a monoclinal flexure; a long narrow pluton raised and tilted a block bounded on three sides by old major faults. The fourth side formed the monocline which eventually stretched and collapsed. No relation is shown between the principal mining areas and the aeromagnetic anomalies. Author

N71-34330*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF THE ATMOSPHERIC-LITHOSTATIC PRESSURE RATIO ON EXPLOSIVE CRATERS IN DRY SOIL
Robert W. Herr Washington Sep. 1971 89 p refs Technical Film Supplement L-1105 available on request.
(NASA-TR-R-366; L-7380) Avail: NTIS CSCL 08G

The size of explosive craters was experimentally investigated by detonating small spherical high-explosive charges at various depths in a bed of particulate soil in a vacuum cylinder. For surface explosions atmospheric pressure has little effect on

crater dimensions, but for charges buried beneath the surface, the dimensionless ratio of atmospheric pressure to lithostatic pressure can be important. For a constant value of this pressure ratio and a range of charge masses of nearly 11 orders of magnitude, crater dimensions varied as the fourth root of the charge mass and inversely as the fourth root of the product of the soil density and gravitational acceleration. Soil permeability had an appreciable effect on crater dimensions. For cratering experiments conducted under standard atmospheric pressure and gravity conditions, the atmosphere had a relatively greater effect on the small explosions than on the large ones at a given value of the charge-depth parameter. Author

N71-34331# RAND Corp., Santa Monica, Calif.
A MATHEMATICAL APPROACH TO ANALYSIS OF ENVIRONMENTAL POLLUTION GENERATED BY MIXES: THE CASE OF ELECTRICAL INTERFERENCE
David Middleton May 1971 68 p refs
(Contract DOT-FR-9-0054)
(R-762-DOT/RC) Avail: NTIS

The problem of determining the effects of electrical interference on communications distributed over linked urban regions is selected as part of the larger problem of evaluating the effects of various regional pollution fields--atmospheric, acoustic, electrical, and spatial--generated by existing and proposed mixes of transportation modes. The approach employed is a generalized application of the techniques of statistical communication theory. Specifically, an exploratory mathematical model containing the physics, the economics, and the inherently statistical character of the interference, is presented. This model is capable of being adapted to computer evaluation for specific interurban configurations. The general approach is illustrated by the specific example of interference to optimal television reception caused by electromagnetic leakage from power stations and power lines in a given area. Author

N71-34332# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF THE ULTRAVIOLET GLOW OF THE ATMOSPHERE AT THE WAVELENGTH 1304 A OXYGEN LINE PERFORMED ON THE COSMOS-215 SATELLITE
E. K. Sheffer 1971 9 p refs Transl. into ENGLISH from Kosmich. Issled. Akad. Nauk SSSR (Moscow), v. 9, no. 2, 1971 p 260-267
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The glow of the earth's upper atmosphere was investigated with the Cosmos-215 satellite at the 1302, 1304, and 1306 angstrom wavelength triplet lines in a broad range of altitudes and solar zenith angles. The characteristics of the detectors and the apparatus parameters are presented. Comparison of results with previous rocket experiments is made. P.N.F.

N71-34333# Lockheed Missiles and Space Co., Palo Alto, Calif.
NIGHT GLOW OF THE ATMOSPHERE IN THE WAVELENGTH 1304 A OXYGEN LINE AT LOW GEOMAGNETIC LATITUDES
E. K. Sheffer 1971 8 p refs Transl. into ENGLISH from Kosmich. Issled. Akad. Nauk SSSR (Moscow), v. 9, no. 1, 1971 p 74-80
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An analysis of nightglow in the 1225 to 1350 A range, belonging to the triplet atomic oxygen lines, recorded in equatorial domains during the flight of Cosmos-215 is presented. A description is given of the orbital elements and experimental equipment onboard the satellite. Peak values of the glow intensity as a function of local observation time are shown. The results from Cosmos-215 are compared with those obtained on the OGO-4 satellite. J.M.

N71-34334# Environmental Protection Agency, Research Triangle Park, N.C.
THE 1969 INVENTORY OF AIR POLLUTION MONITORING EQUIPMENT OPERATED BY STATE AND LOCAL AGENCIES
Mar. 1971 36 p
(PB-198329; APTD-0588) Avail: NTIS CSCL 13B

The air pollution monitoring equipment operated by state and local agencies in the 50 states, District of Columbia, and Puerto Rico are discussed. Reported by state, city and organization are the automatic sampler-analyzers, mechanized samplers,and static sample-collection devices enumerated in the survey for the period July 1, 1968, through June 30, 1969. Included are a sample survey questionnaire, a tabulation of equipment totals, and a glossary of abbreviations and terms. Author(GRA)

N71-34335# Kakioka Magnetic Observatory (Japan).
GEOMAGNETIC AND GEOELECTRIC OBSERVATIONS, 1969 (RAPID VARIATIONS)
1971 89 p
(Rept-10) Avail: NTIS

Japanese cooperative programs for the world-wide observations of the Post-IGC, 1969, observations were carried out by the Kakioka Magnetic Observatory in close cooperation with its two branch magnetic observatories at Memambetsu and Kanoya. At Kakioka, standardization and comparison services of absolute magnetic instruments are operated by the electromagnetic standard magnetometer A-56 and the proton precession magnetometer MO-P. Author

N71-34336# Royal Aircraft Establishment, Farnborough (England).
AIR DENSITY AT HEIGHTS NEAR 180 km IN 1968, AND FROM 1969 THE ORBIT OF 1967-31A
D. G. King-Hele and Doreen M. C. Walker May 1970 34 p refs
(RAE-TR-70084) Avail: NTIS

The ATS 2 orbit was analyzed to obtain 212 values of air density, at heights between 160 and 190 km, during 14 months of high solar activity between 4 July 1968 and 2 September 1969. In general the air density exhibited only a weak dependence on solar activity, but the link between density and geomagnetic disturbances was obvious throughout: the two strongest geomagnetic storms, on 1 November 1968 and 15 May 1969 were accompanied by increases in density of 30% and 70% respectively. When such short-term variations were ignored, the underlying trend was a semi-annual variation in density, with maxima in October-November 1968 and March 1969, and minima in July 1968, January 1969 and July-August 1969. The July minima are deeper than the January minimum, and the average density at the maxima exceeds that at the minima by 32%. A profile of density versus height between 150 and 180 km for mid-1969 was also obtained; and a detailed comparison is made with previous results from 1968-59A. Author

N71-34337# Kyoto Univ. (Japan).
CATALOGUE OF DATA IN THE WORLD DATA CENTER C2 FOR GEOMAGNETISM
Feb. 1971 77 p refs
Avail: NTIS

Pertinent information contained in the catalog includes the following: (1) a listing of geomagnetic stations; (2) the status of data collections, for both geomagnetism and earth current; (3) publications of geomagnetic data received at the WDC C2 for Geomagnetism and the Geophysical Institute, Kyoto University; (4) index of the stations; and (5) data of world magnetic survey. D.L.G.

N71-34338# National Academy of Engineering, Washington, D.C. Environmental Studies Board.
ENVIRONMENTAL PROBLEMS IN SOUTH FLORIDA. PART 2
Mar. 1970 85 p

(PB-199159) Avail: NTIS CSCL 13B

The methods of technology assessment are applied to help determine the environmental effects of building a jetport near the Everglades Park in southern Florida. The study details the safeguards necessary for using the site and recommends further study. A suggestion is made for intensified research on the effect of insect vectors from a tropical reservoir on public health.

Author

N71-34339# National Academy of Engineering, Washington, D.C. Environmental Studies Board.

INSTITUTIONS FOR EFFECTIVE MANAGEMENT OF THE ENVIRONMENT, PART 1

Jan. 1970 71 p

(PB-199180; NAS/NAE-ESB-70-1) Avail: NTIS CSCL 05A

A multidisciplinary approach to the nonscientific aspects of the deterioration of the environment is presented. The existing institutional arrangements for reversing environmental trends were determined to be inadequate. Suggestions are made for the development of new agencies, for research activities in government laboratories, for environmental education programs, and for Federal reorganization in Executive and Legislative branches. Author (GRA)

N71-34340# Wisconsin Univ., Madison. Space Sciences and Engineering Center.

STUDIES ON TECHNIQUES FOR SATELLITE SURVEILLANCE OF GLOBAL ATMOSPHERIC POLLUTION Final Report, 1 Sep. 1969 - 31 Jul. 1970

Michael McClintock, T. A. Hariharan, and Alden McLellan, IV

Sep. 1970 93 p refs

(Contract CPA-22-69-101)

(PB-198821; APTD-0672) Avail: NTIS CSCL 13B

Research on the feasibility of using satellites to study air pollution is discussed. The following areas are considered: remote sensing of particulates; the possibility of calibrating the intensity of specularly reflected sunlight and using this optical source to measure the spectral turbidity of the atmosphere; turbidity from ATS measurements; techniques for remote sensing of gaseous air pollutants; measurement of Co from the SMS Satellite; and the application of lasers to air pollution research.

GRA

N71-34341# Royal Aircraft Establishment, Farnborough (England).

THE SEMIANNUAL VARIATION IN THE UPPER ATMOSPHERE DURING 1967 AND 1968

G. E. Cook Nov. 1969 43 p refs

(RAE-TR-69254) Avail: NTIS

The orbits of five satellites have been analysed to reveal the semi-annual variation in air density at heights between 300 and 505 km during the period of high solar activity in 1967 and 1968, and the results combined with data from other satellites. The semi-annual effect shows considerable variation from cycle to cycle, both in magnitude and in the form of the height dependence. The dates of the maxima and minima given by the individual satellites each year are in very good agreement with each other and are close to the mean values obtained by Jacchia, Slowey and Campbell for the years 1958 to 1966; this suggests the effect is more regular in its timing than has previously been assumed. The main difficulty in interpreting the results is the lack of data at heights below 250 km. At times the observed magnitudes are compatible with a variation solely in exospheric temperature due to temperature changes in the thermosphere, whereas at other times a variation in conditions at the lower boundary near the turbopause (about 110 km) is required. Author

N71-34342# Technische Hogeschool, Eindhoven (Netherlands).

THE OXIDATION OF SEWAGE SLUDGE IN THE LIQUID WATER PHASE AT ELEVATED TEMPERATURES AND PRESSURES (WET-AIR OXIDATION)

Johannes Jacobus Asuerus (Ph.D. Thesis) Apr. 1971 123 p refs

Avail: NTIS

Wet-air oxidation is a method of sewage sludge treatment by which the sludge is oxidized in a liquid water phase in the presence of air at temperatures of about 200-300 C and pressures of 40-120 atm. From an analysis of the literature on the subject it became clear that this process had apparently been developed empirically and that only little insight into the fundamental aspects was present. Because of the attractiveness of wet-air oxidation, a research project was carried out in which a process engineering approach was applied. Author

N71-34343# California Univ., Livermore. Lawrence Radiation Lab.

GROUND WAVES STIMULATED BY SURFACE BLAST [O VOLNAKH V GRUNTE, VOZBUSHDAEMYKH NAZEMNYM VZRYVOM]

S. S. Grigoryan et al Dec. 1969 79 p refs Transl. into ENGLISH from Russian report no. 947 Sponsored by AEC

(UCRL-Trans-10629) Avail: NTIS

The dynamic problem for semi-distance occupied by the ground was studied based on a model of soft ground. The question posed and calculated concerns the ground motion from the effect of the strong blast air wave over the surface of the semi-distance. The determination is carried through the late stages. Author

N71-34344# Joint Publications Research Service, Washington, D.C.

GRAVITY ANOMALIES IN THE SEA OF JAPAN

P. A. Stroyev 1 Sep. 1971 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 198, no. 4, 1971 818-821 Presented at the 1st Soviet-Japanese Seminar on the Upper Mantle Nakhodka, Japan, Oct. 1970

(JPRS-53962) Avail: NTIS

The measurement and analysis of gravity anomalies in the Sea of Japan is discussed. The systematic study of the gravitational forces in this area began in 1965. With the development of gravimeters having a continuous recording the measurement of gravitational forces was performed on ships while underway. This step increased the effectiveness of the studies and allowed the conduct of measurements over 50 to 90 percent of the ships course. Author

N71-34345# Joint Publications Research Service, Washington, D.C.

POLAR ICE AS A FACTOR IN CLIMATE FORMATION

M. I. Budyko 3 Sep. 1971 31 p refs Transl. into ENGLISH from the book "Klimat i Zhizn" USSR, 1971 p 248-274

(JPRS-53987) Avail: NTIS

The mutual interactions between Arctic ice and climate are investigated, emphasizing the heat budget of the northern area. Atmospheric temperature and currents, oceanic temperature and currents, albedo, heat transport, and polar cap thickness are considered for each season. The radiation balances of the earth-atmosphere system are found to have negative values even for summer, and the lost heat energy is replaced by the advective heat inflow from the lower latitudes. The possibility of an ice-free regime is also considered, and the resulting, tremendous changes in climate of the whole earth are described.

N.E.N.

N71-34346# California Univ., Berkeley. Hydraulic Engineering Lab.

FIELD AND LABORATORY STUDIES NAVIGATION CHANNELS OF THE COLUMBIA RIVER ESTUARY

M. P. O'Brien May 1971 36 p refs

(Contract DACW72-71-C-0005)

(AD-724100; HEL-24-4) Avail: NTIS CSCL 14/2

The construction and characteristics of a model of the estuary of the Columbia River are discussed. The model was

constructed in order to study the effects of changing the navigation channels on water flow and sedimentation. Background information on the regimen of the Columbia River is presented to provide increased appreciation of the problem.
Author

N71-34347# Naval Civil Engineering Lab., Port Hueneme, Calif.
OCEAN ENGINEERING SIGNIFICANCE OF MARINE SEISMIC REFLECTION PROFILING TECHNOLOGY Final Report, Jul. 1969 - May 1970
E. F. Pawlowicz May 1971 52 p refs
(AD-724674; NCEL-TN-1157) Avail: NTIS CSCL 08/10

Seismic reflection profiling SRP data of value to the seafloor engineer include: (1) sediment soil thickness; (2) sediment structure; (3) the slope of the bedrock beneath the sediment layer; (4) bedrock topography, is sufficient tracklines are run to permit contouring; (5) bedrock structure, if penetration permits; and (6) acoustical data from which certain physical, engineering, and load bearing properties of an area can be approximated. Qualitative interpretations of acoustical data are made as a matter of course by the experienced analyzer of SRP records and include such parameters as: echo intensity from the seafloor and subbottom interfaces, indicating hard high reflectivity and soft low reflectivity layers; penetrability of the seafloor (in unconsolidated sediments) is generally inversely proportional to grain size; point return, or discrete hyperbolic echo returns, indicative of large irregularities compared to the sound frequency recorded, such as boulder beds, or a weathered bedrock surface.
Author (GRA)

N71-34348 National Lending Library for Science and Technology, Boston Spa (England).
SOLID GAS
N. Ilyinskaya 26 Mar. 1971 4 p Transl. into ENGLISH from Sotshk. Industria (USSR), 26 Mar. 1971
(NLL-M-20582-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The existence of solid natural gas deposits in permafrost areas is examined. Rocks from the Messoyakha layers revealed that under temperatures from 0 to minus 52 C and pressures of 10 to 250 atmospheres, pressure was eventually reduced, indicating solid physicochemical compounds had formed.
E.H.W.

N71-34349 National Lending Library for Science and Technology, Boston Spa (England).
WHAT IF POLAR ICE IS DESTROYED?
H. P. Pogosjan [1971] 14 p Transl. into ENGLISH from Priroda (USSR), no. 6, 1970 p 74-79
(NLL-M-20595-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The atmospheric circulation in the Northern Hemisphere is reviewed including the circulation during winter, summer, and transition seasons. Possible changes in the atmospheric circulation and climatology which might occur if the secular polar ice were destroyed are discussed.
J.M.

N71-34350 National Lending Library for Science and Technology, Boston Spa (England).
RADIATION EFFECT OF A DUST LAYER
K. S. Sifrin [1971] 12 p refs Transl. into ENGLISH from Tr. Glav. Geofiz. Observ. (Leningrad), 1969 p 243-253
(NLL-M-20598-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The radiation attenuation of the dust layer, caused by volcanic eruptions or entry of meteors, in the upper layer of the troposphere or the stratosphere is investigated. The ratio of the attenuation of total radiation to the attenuation of direct radiation is estimated. Calculations for two models, where the particles from a thin localized layer, and where the particles are uniformly mixed through the whole depth of the atmosphere, are given.
E.H.W.

N71-34351 National Lending Library for Science and Technology, Boston Spa (England).
USE OF STATISTICAL METHODS IN THE PROCESSING OF OBSERVATIONAL DATA ON AIR POLLUTION
E. Ju. Bezuglaja [1971] 10 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), v. 238, 1969 p 42-47
(NLL-M-20589-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The logarithmic normal law for the probability distribution of impurities in the air is developed and a procedure is given for plotting the concentration of the impurties on a graph in accordance with the law. The advantages of analyzing air pollution data by means of the probability graph are discussed.
J.G.M.

N71-34352 National Lending Library for Science and Technology, Boston Spa (England).
INVESTIGATION OF THE ATMOSPHERIC TRANSMISSIVITY REGIME
Z. I. Pivovarova et al [1971] 7 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), 1969 p 159-163
(NLL-M-20597-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The distribution in time and space of the atmospheric transmissivity coefficient for the solar radiation integrated flux is discussed. Bouger's formula was used in transmission coefficient calculations based on long-term monthly mean flux density data for 1954 to 1963 from 175 U.S.S.R. actinometrical stations. Atmospheric transmission coefficients and aerosol coefficients of radiation attenuation were compared.
J.M.

N71-34353 National Lending Library for Science and Technology, Boston Spa (England).
FEATURES OF THE THERMAL REGIMES OF TOWNS
G. P. Restorgueva [1971] 14 p refs Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), v. 238, 1969 p 145-152
(NLL-M-20722-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The diurnal and annual variations in the vertical and horizontal meteorological measurements in Donetska, Ukraine, are reported, and results of studies made in cities over the globe are reviewed. Donetska is in an area of broken relief with differences of 100 m between high and low areas, with the central, most built-up parts of the city on the highest areas. Temperature and humidity measurements were taken at 0.5 and 1.5 m above ground with aspiration psychrometers, and the surface temperature was determined from a standard mercury thermometer. Wind speeds at 0.5 and 2.0 m were measured by hand anemometers, and wind direction by a small pennant and a compass. The data show that a heat island is formed in the afternoon, and the intensification of town influence on the thermal regime results from intense heat emission in the town center and the relative increase of air temperature in the highest part of town.
N.E.N.

N71-34354 National Lending Library for Science and Technology, Boston Spa (England).
TWO YEAR CYCLE IN FLUCTUATIONS OF THE ICE COVER
N. A. Volkov et al [1971] 10 p refs Transl. into ENGLISH from Problemy Arktiki i Antarktiki (Leningrad), no. 34, 1970 p 13-19 In ENGLISH and RUSSIAN
(NLL-M-20593-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The investigation of space-time regularities in the biennial cycle in the fluctuations of the ice in the Arctic seas was one phase in the study of the problem of long range and super long range forecasting of climate, weather, oceanic processes, and ice conditions. Statistical data is presented which establishes the existence of biennial ice-amount cycles in the Arctic seas. A study of the cycle in space-time coordinates revealed large scale regularities in the peculiarities of its geographic distribution and development in time, and enabled the conclusion to be reached

that a system existed which is a circumpolar wave of ice-amount changing to the given cycle. Author

N71-34356 National Lending Library for Science and Technology, Boston Spa (England).
INTERACTION BETWEEN WATER TEMPERATURE AND AIR TEMPERATURE FIELDS IN THE NORTH ATLANTIC
M. A. Dujoeva et al [1971] 17 p refs Transl. into ENGLISH from Gidromet. Nauk. Issled. Cent. SSSR (Leningrad), no. 6-3, 1969 p 43-56
(NLL-M-20724-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Different methods of determining the thermal interactions between the lower air level and the upper water level are described, and their results are discussed. Among the conclusions are the following: There is a close connection between the monthly mean temperature anomalies for air and water layers, for all indicators, and for the time coefficient it is complicated. The rate of convergence of the terms of the expansion is greater for the air temperature anomaly than for the water anomaly. The fields of the eigenvectors do not coincide for the air and water temperature anomalies. For forecasting schemes, data on the water temperature anomaly must be included for best results; if they are lacking, data on the air anomaly may be used. A classification of the anomaly fields is made according to the degree of anomaly. It is shown that a close connection exists between the degree of anomaly and its types. There is also a connection between the degree of anomaly and the intensity of zonal circulation of the atmosphere at 500 m. N.E.N.

N71-34386 National Lending Library for Science and Technology, Boston Spa (England).
A MEASURE OF THERMAL STABILITY IN THE SURFACE LAYER OF AIR
V. P. Gracheva [1971] 19 p refs Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), no. 238, 1969 p 153-179
(NLL-M-20714-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The distribution of the surface layer stability parameter over the U.S.S.R. and over time was analyzed. The territorial distribution is considered for the meteorological conditions which cause the diffusion of impurities from high smokestacks. As this was assumed to be on a summer afternoon when turbulent exchange is well-developed, gradient observations for 1300 hours in July were used. Data for 67 stations over the 1955 - 1967 period were processed. To study the variation of the stability parameter in time, diurnal and annual variations were determined for a 5-year period (1963 - 1967) for 7 stations in different landscape zones. Calculation methods are described, and tabulated data show stability parameter variations over the different zones. Author

N71-34357 National Lending Library for Science and Technology, Boston Spa (England).
DEFORMATION FORCES AND LONG RANGE FORECASTING OF THE PRESSURE FIELD IN THE EARTH'S NORTHERN HEMISPHERE
I. V. Maksimov [1971] 15 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauchn-issled. Inst. (Leningrad), v. 286, 1970 p 289-302
(NLL-M-20599-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Equations were developed for calculating the deformation of the level surface of the world ocean in relation to the distribution of the gravitational force over the earth's surface. The approximate values of the anomalies of the gravitational force were calculated for every 10 deg geographical square over the entire earth. Also, for every latitude, the departures of these values from the mean were calculated. The anomalies found were used with the equation in the calculation of the departures, due to deformation, of the ocean level from its mean gravitational values. The resulting chart of deformation anomalies of the ocean level was compared with the accepted distribution of the atmospheric pressure means in the Northern Hemisphere and found to be indentical. A discussion of the relationships between these curves is presented. J.G.M.

N71-34358 National Lending Library for Science and Technology, Boston Spa (England).
CALCULATION OF ATMOSPHERIC POLLUTION FROM MANY SOURCES
I. G. Gracheva et al [1971] 23 p refs Transl. into ENGLISH from Tr. Gl. Geofiz Observ. (Leningrad), no. 238, 1969 p 14-26
(NLL-M-20634-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A computer program for the calculation of the atmospheric pollution from many sources is presented. The numerical analysis is based on factors such as stratification of the planetary boundary layer, height of the chimney, volume of gas mixture emitted by the chimney, and efficiency of cleaning devices. Various equations are presented which form a numerical correlation between the factors producing air pollution. Author

N71-34389 Arizona Univ., Tucson.
RADIATIVE FLUX DENSITIES AND HEATING RATES IN THE ATMOSPHERE USING PRESSURE- AND TEMPERATURE-DEPENDENT EMISSIVITIES
Gerald Michael Jurica (Ph.D. Thesis) 1970 208 p
Avail: Univ. Microfilms Order No. 70-15419

Tables of emissivities for water vapor, carbon dioxide, and ozone are presented along with tables of a correction quantity which accounts for overlap of the 15 micron carbon dioxide band and the water vapor rotation band. After adopting the quasi-random band model and more recent data on water vapor bands, a detailed treatment to the data and compute improved values of water vapor emissivity are applied. In order to estimate the relative importance of the pressure and temperature effects, the improved water vapor emissivities and the Curtis-Godson approximation are used to compute flux densities and heating rates for several atmospheric soundings. In flux density calculations, values computed using temperature-dependent emissivities and the Curtis-Godson approximation differ by nearly equal amounts from those obtained using each of these two methods separately. Heating rates appear to be more sensitive to the pressure-scaling technique. Dissert. Abstr.

N71-35000# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astron., and Space, No. 257 30 Jul. 1971 p 16-20 refs (See N71-34997 21-30)
Avail: NTIS

N71-35001# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astron., and Space, No. 257. 30 Jul. 1971 p 21-25 refs (See N71-34997 21-30)
Avail: NTIS

N71-35002# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astron., and Space, No. 257 30 Jul. 1971 p 26-56 refs (See N71-34997 21-30)
Avail: NTIS

N71-35007# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, no.

258 13 Aug. 1971 p 14-18 refs (See N71-35004 21-30)
Avail: NTIS

N71-35008# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, no. 258 13 Aug. 1971 p 19-23 refs (See N71-35004 21-30)
Avail: NTIS

N71-35009# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, no. 258 13 Aug. 1971 p 24-41 refs (See N71-35004 21-30)
Avail: NTIS

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-34360*# Geological Survey, Washington, D.C.
RECOGNITION OF SETTLEMENT PATTERNS AGAINST A COMPLEX BACKGROUND
Robert B. Simpson and David T. Lindgren May 1970 42 p refs Prepared in cooperation with Dartmouth Coll.
(NASA Order W-12570; NASA Order W-12572; Contract DI-14-08-0001-G-8)
(NASA-CR-121652; USGS-208) Avail: NTIS CSCL 14E

The application of aerial photointerpretation procedures to urban analysis to the estimation of dwelling units in areas of high population density is discussed. Color infrared photography of metropolitan Boston of a scale 1:20,000 was examined and found to be capable of providing the signatures necessary for making accurate dwelling unit estimates. Author

N71-34361*# Geological Survey, Washington, D.C.
PREDICTING THE RELATIVE DYE LAYER DENSITIES OF COLOR INFRARED TRANSPARENCIES
Robert W. Pease (Calif. Univ., Riverside) Jan. 1969 36 p refs
(NASA Order R-09-020-024)
(NASA-CR-121650; IR-NASA-146) Avail: NTIS CSCL 17E

A graphical method is presented whereby relative dye-layer densities of color infrared image (CIR) elements can be derived from known reflectance curves. Application of the method is made for some common image targets showing (1) how plant reflection yields a red record, (2) the unbalancing effect of air luminance on the color of the image, (3) the reshaping of the spectral distribution of energy reaching the film with auxiliary filters to overcome this imbalance, and (4) the nature of the record for certain targets other than vegetation both at close range and aloft. In addition, an analysis is made using the method to show the effect of spectral characteristics of certain spacecraft windows on possible CIR photography through them. Space-deteriorated coatings will not yield a satisfactory CIR image whereas non-deteriorated or uncoated windows will do so. Author

N71-34362*# Texas Univ., Dallas.
EXPLORER 31 ION MASS SPECTROMETER EXPERIMENT Final Report
William P. Lord 25 Jul. 1971 44 p refs
(Contracts NAS5-9444; NSR-44-004-089)
(NASA-CR-121651) Avail: NTIS CSCL 14B

The work accomplished in reducing ionosphere composition data from the ion mass spectrometer experiment of the Explorer 31 satellite is reported. The project background and objectives, and the project results are described. Techniques used in processing the data are outlined as well as the experiment data. A brief description of the ion mass spectrometer instrument is included. Author

N71-34363*# California Univ., La Jolla. Dept. of Radiology.
A FLUOROPLANIGRAPHY SYSTEM FOR RAPID PRESENTATION OF SINGLE PLANE BODY SECTIONS
Elliot C. Lasser, Norman A. Bailey, and Ronald L. Crepeau [1971] 9 p refs
(Grant NGL-05-009-103)
(NASA-CR-111944) Avail: NTIS CSCL 14B

A single-scan TV radiography unit was coupled to the moving film holder of a conventional overhead tube fluoroscopy unit so that it can be used in a tomographic mode. The method produces a true tomographic section which is presented immediately on the TV monitor. Field size and section thickness were found to be satisfactory. The system allows rapid location of the plane and area of interest. Patient dose per exposure, when compared to fast film, for thick body parts was found to be reduced by approximately 7 to 55 times. Author

N71-34364*# IIT Research Inst., Chicago, Ill.
MAGNETIC HEAD/TAPE INTERFACE STUDY FOR SATELLITE TAPE RECORDERS. VOLUME 3: TEST METHODS AND PROCEDURES Technical Report, 1 Dec. 1968 - 31 Dec. 1970
Robert J. Owen Feb. 1971 135 p refs 3 Vol.
(Contract NAS5-11622; IITRI Proj. E6134)
(NASA-CR-121649) Avail: NTIS CSCL 14E

The chemical analysis required to identify the types of polymers used in the fabrication of magnetic tape, as well as the quantities of additives incorporated is described. The tape types selected for the evaluation of tape related parameters throughout the test program are discussed. In addition to the chemical analysis, certain other physical and mechanical properties of these tapes were measured. The types of tests used to determine the adhesion and debris performance of the heads and tapes investigated are summarized, test procedures are discussed, and sample results are presented. Author

N71-34365*# IIT Research Inst., Chicago, Ill.
MAGNETIC HEAD/TAPE INTERFACE STUDY FOR SATELLITE TAPE RECORDERS. VOLUME 2: TEST PROGRAM AND RESULTS Technical Report, 1 Dec. - 31 Dec. 1970
Robert J. Owen Feb. 1971 304 p refs 3 Vol.
(Contract NAS5-11622; IITRI Proj. E6134)
(NASA-CR-121700) Avail: NTIS HC $6.00/MF $0.95 CSCL 14E

The chemical and physical forces existing at the interface between the heads and the magnetic tape were investigated to determine a magnetic tape and head combination which will function without impairment for a period of one year in satellite tape recorders. A survey of appropriate manufacturers and users in the satellite recording industry was conducted to isolate and identify the underlying causes of tape failures. Included in the survey was a determination of the extent to which problems have occurred, the nature of the failures, and what, if any, corrective actions have been taken. A study plan was prepared to isolate a number of factors attendant to the head/tape interaction, and to establish correlations between these parameters and the failure modes identified. Author

N71-34366*# IIT Research Inst., Chicago, Ill.
MAGNETIC HEAD/TAPE INTERFACE STUDY FOR SATELLITE TAPE RECORDERS. VOLUME 1: GUIDELINES FOR SELECTION AND USE Technical Report, 1 Dec. 1968 - 31 Dec. 1970

Robert J. Owen Feb. 1971 35 p refs 3 Vol.
(Contract NAS5-11622; IITRI Proj. E6134)
(NASA-CR-121701) Avail: NTIS CSCL 14E

A list of guidelines for the design, selection, and use of magnetic heads and tape in unattended satellite applications is presented. A substantial portion of the test program was directed toward the determination of factors relating to the frictional drag and debris performance of the head and tape combinations. Hence, the guidelines presented were designed to minimize the occurrence of problems in these two areas. The parameters found to be significant in tape and head selection, and operational constraints in using the heads and tapes selected were discussed in detail. Author

N71-34367*# Arizona Univ., Tucson. Field Emission and Space Systems Lab.
DIRECTION TECHNIQUES FOR TENUOUS PLANETARY ATMOSPHERES Semiannual Report, 1 Jan. - 30 Jun. 1971
Stuart A. Hoenig 30 Jun. 1971 31 p refs
(Grant NGL-03-002-019)
(NASA-CR-121660; SAR-18) Avail: NTIS CSCL 14B

The development of new types of detectors for analysis of planetary atmospheres is discussed. Initially, the interest was in detectors for use under partial vacuum conditions. The program has been extended to include detectors for use at one atmosphere and adsorption system for control and separation of gases. Detectors for O2 and H2 under partial vacuum conditions are described. Experiments on detectors for use at higher pressures, and systems for CO, H2, and O2, were reported. An electrically controlled adsorbent was developed. It was demonstrated that under proper conditions a thin film of semiconductor material could be electrically cycled to adsorb and desorb a specific gas. This work was extended to obtain quantitative data on the use of semiconductors as controllable adsorbents. Author

N71-34368*# Lockheed Missiles and Space Co., Palo Alto, Calif.
DEVELOPMENT OF TECHNIQUES AND ASSOCIATED INSTRUMENTATION FOR HIGH TEMPERATURE EMISSIVITY MEASUREMENTS Interim Report, 29 Jun. 1970 - 29 Jun. 1971
G. R. Cunnington and A. I. Funai 29 Jun. 1971 34 p refs
(Contract NAS8-26304)
(NASA-CR-119920; LMSC-N-JF-71-3) Avail: NTIS CSCL 14B

A method and apparatus are proposed for determining the high temperature emittance of thermal protection materials for use on the space shuttle and for evaluating the effects of such reentry environment parameters as temperature, pressure, flow velocity, and gas temperature on the emittance stability. Author

N71-34369*# Venzetti Infrared and Computer Systems, Inc., Dedham, Mass.
THE ESTABLISHMENT OF PROCEDURES FOR THE APPLICATION OF INFRARED TECHNIQUES FOR THE ENHANCEMENT OF LARGE SCALE INTEGRATION (LSI) RELIABILITY Final Report
31 Mar. 1971 121 p
(Contract NAS8-25862)
(NASA-CR-119921; DCN-1-0-60-00030(1F); SI(1F)) Avail: NTIS CSCL 17E

The application of infrared inspection techniques to the improvement of large scale integration reliability is discussed. The verification of adequate reliability and general acceptance usage are emphasized. The attainment of high reliability is a prerequisite for widespread acceptance of large scale integration. Author

N71-34370*# California Univ., Berkeley. Space Sciences Lab.
A SUPERCONDUCTING MAGNETIC SPECTROMETER FOR COSMIC RAY NUCLEI
L. H. Smith, A. Buffington, M. A. Wahlig (Calif. Univ., Berkeley. Lawrence Radiation Lab.), and P. Dauber (Calif. Univ., Berkeley. Lawrence Radiation Lab.) Jul. 1971 35 p refs Submitted for publication its Space Sci Lab. Ser. No. 12 Issue 47
(Contract NAS9-7801)
(NASA-CR-121709) Avail: NTIS CSCL 14B

The design, calibration, and operation of a magnetic spectrometer for particle astronomy is described. The spectrometer consists of a cryogenic magnet, optical spark chambers, scintillation detectors, and associated electronics. The instrument has been flown in a balloon gondola to 4.8 grams/cm sq residual atmosphere, where it was used to analyzed the charge and differential rigidity spectra of primary nuclei from 5 to 100 GV/c. Author

N71-34371*# Pittsburgh Univ., Pa. Graduate School of Public Health.
MICROCHEMICAL SURFACE ANALYSIS BY ELECTRON SPECTROSCOPY Final Technical Report
26 Jul. 1971 93 p refs
(Grant NGR-30-011-096)
(NASA-CR-111968) Avail: NTIS CSCL 14B

The development of an Auger electron velocity analyzer suitable for the specific requirements of the SEM and for use in the study of surface phenomena on semiconductor devices is reported. Fundamental studies on Auger and characteristic electron energy loss peaks are described. These studies were made to explain the various physical mechanisms responsible for the different types of characteristic-losses and the factors determining the shapes and position of Auger and characteristic peaks in order to permit eventual quantitative analysis by electron spectroscopy. Technical results, necessary drawings, and detailed instructions for the operation of the prototype Auger analysis system are presented. Author

N71-34372*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A FIRST ORDER THEORY FOR ROTATING GRAVITY GRADIOMETERS
Robert L. Holland 16 Apr. 1971 26 p refs
(NASA-TM-X-64605) Avail: NTIS CSCL 14B

The equations of motion for a rotating gradiometer are developed and specialized to a forced harmonic oscillator model that may be solved analytically. Numerical results are given, comparing the analytical approximation to numerical integration of the exact equations. Author

N71-34373*# IIT Research Inst., Chicago, Ill.
MM-71 MAGNETIC HEAD/TAPE STICK-SLIP STUDY Final Report
George S. L. Benn Feb. 1971 127 p ref Prepared for JPL
(Contracts NAS7-100; JPL-952832; IITRI Proj. E6169)
(NASA-CR-121730) Avail: NTIS CSCL 14C

The head to tape interface problems peculiar to the special requirements of the Mariner Mars 1971 data storage subsystem tape transport were investigated. A series of tests were conducted in which the magnetic heads, magnetic tape, tape tension, wrap angle, tape speed, and number of tape passes were controlled as the basic test variables. The relationship between these tests variables and their correlation with the stick-slip phenomena was established by analyzing certain test parameters which included drag forces, dynamic tape tension, tape flutter, dropouts, and output signal characteristics. The change in value of certain test parameters with increasing number of tape passes allowed distinct patterns of performance to be extracted for certain combinations of test variables. Further analysis allowed these combinations to be ranked in order of their desirability in minimizing the stick-slip phenomena. Author

N71-34374*# Ball Bros. Research Corp., Boulder, Colo.
CIT PHOTOHELIOGRAPH DEFINITION STUDY. VOLUME 3: DEVELOPMENT PROGRAM PLAN Final Report

Apr. 1971 63 p
(Contract NAS8-30190)
(NASA-CR-119781; F71-02; MSFC DRL-212-Vol-3) Avail: NTIS CSCL 14B

An improved design of a photoheliograph compatible with an ATM class mission is discussed. The system requirements were configured into modules: (1)the telescope, (2) instrumentation, and (3) support modules. The telescope module performs the function of imaging a portion of the Sun for measurement by the complement of data cameras in the instrumentation module. The electrical and electronic management equipment is contained in the support module. The photoheliograph is compatible with the ATM and also with other carriers of major scientific hardware. Author

N71-34376*# California Univ., Riverside. Dept. of Geography.
A SYSTEM OF REGIONAL AGRICULTURAL LAND USE MAPPING TESTED AGAINST SMALL SCALE APOLLO 9 COLOR INFRARED PHOTOGRAPHY OF THE IMPERIAL VALLEY (CALIFORNIA) Final Report
Claude W. Johnson, Leonard W. Bowden, and Robert W. Pease Nov. 1969 104 p refs Prepared for Geological Survey
(NASA Order W-12570; DI-14-08-0001-10674)
(NASA-CR-121875; USGS-183; USGS-DO-71-009) Avail: NTIS CSCL 14E

Interpretation results of the small scale CIR photography of the Imperial Valley (California) taken on March 12, 1969 by the Apollo 9 earth orbiting satellite show that world wide agricultural land use mapping can be accomplished from satellite CIR imagery if sufficient a priori information is available for the region being mapped. Correlation of results with actual data is encouraging although the accuracy of identification of specific crops from the single image is poor. The poor results can be partly attributed to only one image taken during mid-season when the three major crops were reflecting approximately the same and their CIR image appears to indicate the same crop type. However, some incapacity can be attributed to lack of understanding of the subtle variations of visual and infrared color reflectance of vegetation and surrounding environment. Analysis of integrated color variations of the vegetation and background environment recorded on CIR imagery is discussed. Author

N71-34376*# Arkansas Univ., Little Rock. Dept. of Electronics and Instrumentation.
A SYMMETRICAL LASER DOPPLER VELOCITY METER AND ITS APPLICATION TO TURBULENCE CHARACTERIZATION
M. K. Mazumder 1 May 1971 204 p refs
(Grant NGL-04-001-007)
(NASA-CR-121872) Avail: NTIS CSCL 14B

A symmetrical method of optical heterodyning of the Doppler shifted scattered laser radiation was developed for velocity measurements with a minimal instrumental spectral broadening and a high signal-to-noise ratio. The method employs two laser beams incident on the moving scatterer and does not use any reference beam for heterodyning. The Doppler signal frequency is independent of the scattering angle and the signal possesses no receiving aperture broadening. Typical values of the instrumental spectral broadening were approximately 0.8 percent of the center frequency of the Doppler signal, and the signal-to-noise ratio was approximately 25 dB, obtained from an air flow system using submicron dioctylphthalate scattering aerosol. Experimental and theoretical studies were made on the characteristics of the Doppler signal and the effect of system parameters in turbulent flow measurement. The optimization process involved in the beam optics and in the use of a spatial filter is described. Author

N71-34377*# University of Southern Calif., Los Angeles. Dept. of Physics.
DEVELOPMENT OF A SUPERCONDUCTING BOLOMETER Final Report, period ending 28 Feb. 1970
Darrell L. Judge 28 Feb. 1970 50 p refs
(Grant NGR-05-018-007)
(NASA-CR-121672) Avail: NTIS CSCL 14B

A fully operational superconducting bolometer has been developed. It operates in the transition region between the superconducting and normal states of lead. It has a noise equivalent power (NEP) of 10 to the minus 11 watts, a sensitivity of 70 volts/microwatt, and a primary response time of 8 milliseconds. The wide spectral range, high sensitivity, and low noise make this a valuable absolute detector for many applications, particularly in the vacuum ultraviolet. The NEP and sensitivity for the bolometer do not, however, represent a fundamental limit for such detectors. This new bolometer is in no way limited to work in the ultraviolet, but should be of interest to those working in the far infrared. Author

N71-34378*# Scientific Translation Service, Santa Barbara, Calif.
INFRARED PHOTOGRAPHS OF THE EARTH FROM SATELLITES AND POSSIBILITIES OF THEIR APPLICATION [INFRAROTAUFNAHMEN DER ERDE VON SATELLITEN UND IHRE AUSSAGEMOEGLICHKEIT]
Heinz Kaminski Washington NASA Sep. 1971 20 p refs Transl. into ENGLISH from J. Naturwiss. Rundschau (West Germany), v. 24, no. 6, Jun. 1971 p 244-252
(Contract NASw-2035)
(NASA-TT-F-13930) Avail: NTIS CSCL 14E

The history and applications of infrared photography are reviewed from their beginnings. Ground and satellite infrared instrumentation are explained. Practical uses of satellite infrared photographs include the following: determination of inhabited regions on the Earth, volcano research, glaciology, ocean ice determination, hydrology, energy radiation balance of the Earth. Author

N71-34379*# Texas Univ., Dallas.
EXPLORER 31 ION MASS SPECTROMETER EXPERIMENT Published Papers as of Jul. 1971
Jul. 1971 50 p refs Repr. from various publications
(Contract NAS5-9444; Grant NSR-44-004-089)
(NASA-CR-121865) Avail: NTIS CSCL 14B

Data from a magnetic mass spectrometer flown on the Explorer 31 satellite show that the ionosphere above 1000 kilometers usually consists of hydrogen ions as the predominant species. Between this altitude and perigee (500 kilometers) the dominant ion species shifts to atomic oxygen, with a significant amount of atomic nitrogen ions also present. Helium ions are present in small quantities at all altitudes. Other minor ions observed are those of 2, 7, 8, 15, 18, and 20 atomic mass units. Author

N71-34380# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
INTEGRATOR OF NANOSECOND SIGNALS WITH CONTROL
Yu. G. Budyashov, N. G. Zinov, and B. J. Krasnoborodov 1971 7 p In RUSSIAN
(JINR-P13-5742) Avail: AEC Depository Libraries

A scheme is described which is designed for the linear gating of nanosecond signals with their simultaneous extension to the duration providing the normal operation of a multichannel analyzer. The value of the base from the controlling signal is regulated as desired and can be both of positive and negative sign. Author (NSA)

N71-34381# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
MACH METER USING SEMICONDUCTOR DETECTORS FOR NUCLEAR RADIATION [MACHMETRE A DETECTEURS SEMI-CONDUCTEURS DE RAYONNEMENTS NUCLEAIRES]
Louis Gilly, Paul Jourdan, and Pierre Denis Jan. 1971 121 p refs In FRENCH

(CEA-R-4107) Avail: AEC Depository Libraries

The described machmeter uses semiconductor detectors. It detects alpha particles produced by americium 241 sources. Pulses issued from each of these detectors are amplified and dispatched in two electronic chains into a simplified calculator which gives Mach number. It is possible to associate electronic chains for obtaining separate information of altitude and Mach number. It may be used for stabilizing altitude. Systematic analysis of experimental errors is made. Author (NSA)

N71-34382*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MICROMETEROID ANALYZER Patent Application

Siegfried O. Auer, inventor (to NASA) Filed 26 Mar. 1971 28 p

(NASA-Case-ARC-10443-1; US-Patent-Appl-SN-128419) Avail: NTIS CSCL 14B

A system for measuring the direction of flight, velocity, charge, mass, and chemical composition of micrometeoroids is described. The analyzer includes two spaced arrays of interconnected capacitors and an ion detector. Electrodes are fastened to the edge of each array. Micrometeoroids impinge on the arrays and generate signals at the electrodes. The magnitude of the signals is a function of the impact location. Ions accelerated from one array are focused on an ion detector to provide a time-of-flight mass spectrometer. NASA

N71-34383*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

PARALLEL-PLATE VISCOMETER WITH DOUBLE-DIAPHRAGM SUSPENSION Patent Application

Thomas H. Sauer, inventor (to NASA), Robert F. Landel, inventor (to NASA), Robert F. Fedors, inventor (to NASA), and Harry T. Fearnehough, inventor (to NASA) Filed 12 May 1971 27 p

(Contract NAS7-100)

(NASA-Case-NPO-11387; US-Patent-Appl-SN-142719) Avail: NTIS CSCL 14B

A parallel plate viscometer which permits relatively frictionless drop of the upper plate while preventing any significant lateral or tilting motion of the plate or transmission of vibration is described. The viscometer provides a simplified technique for measuring viscosity and may be used for providing a quick and accurate determination of absolute viscosity of liquids and viscoelastic materials. NASA

N71-34384*# National Aeronautics and Space Administration, Washington, D.C.

VEHICLE SPEED AND CRUISE CONTROL SYSTEM Patent Application

Albert A. Permut, inventor (to NASA), Ronald M. Permut, inventor (to NASA), and Alan R. Permut, inventor (to NASA) Filed 13 May 1971 29 p

(NASA-Case-NUC-11103; US-Patent-Appl-SN-143079) Avail: NTIS CSCL 14B

A vehicle speed control system is disclosed in which a train of pulses, at a frequency directly related to actual vehicle speed, is generated. A second train of pulses is generated at a frequency which is directly related to maxium vehicle speed. The frequency of the second pulse train is controlled either manually or by the code of any one of several coded signals received by the system's receiver from a low power transmitter. When the frequency of the first train exceeds that of the second train, a restraining force is generated which is applied to the vehicle's throttle mechanism in opposition to the force or pressure applied by the operator's foot. NASA

N71-34385*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

WATER SURFACE DEPTH INSTRUMENT Patent Application

Quinton C. Davis, IV, inventor (to NASA) Filed 23 Feb. 1971 p

(NASA-Case-LAR-10576-1; US-Patent-Appl-SN-117984) Avail: NTIS CSCL 14B

An instrument is described which is used to measure the depth of liquid on a plane surface with particular application to measuring the depth of water above the surface of airport runways. The instrument can be set on the runway surface and will give an immediate reading of the depth of water covering the runway. NASA

N71-34386*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

TACHOMETER Patent Application

James R. Currie, inventor (to NASA) and Ralph R. Kissel, inventor (to NASA) Filed 13 Jul. 1971 18 p

(NASA-Case-MFS-20418; US-Patent-Appl-SN-162101) Avail: NTIS CSCL 14B

An instantaneous reading tachometer is described in which reoccurring events, to be measured in rate, trigger a three-state timing generator. The first two states are of fixed duration and the third state is of variable duration. An electrical decay circuit is set to a reference level by the second state and the third state causes this reference level to decay until the reoccurrence of an event. This triggers a new first state which in turn triggers a sample and hold circuit to hold the decayed level. The decayed level is amplified and provided as an output indicative of the instantaneous rate of occurrence of the last two successive events. An application is described for generating three discrete levels for each heart beat as represented by ECG signals. NASA

N71-34387*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SELF RECORDING PORTABLE SOIL PENETROMETER Patent Application

Nicholas C. Costes, inventor (to NASA), Rolland G. Sturm, inventor (to NASA) (Brown Eng. Co., Inc.), George E. Campbell, inventor (to NASA) (Brown Eng. Co., Inc.), and Roland H. Norton, inventor (to NASA) (Brown Eng. Co., Inc.) Filed 9 Jul. 1971 19 p

(Contract NAS8-20166)

(NASA-Case-MFS-20774; US-Patent-Appl-SN-161028) Avail: NTIS CSCL 14B

A lightweight, portable penetrometer for testing the soil characteristics of the lunar surface is described. The instrument is composed of a handle, data recording, and probe components detachably joined together. The data recording component has an easily removed recording drum which rotates according to the downward force applied on the handle and a stylus means for marking the drum along its height according to the penetration depth of the penetrometer into the soil. NASA

N71-34388*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

IMPROVED IRRADIANCE MEASURING DEVICE Patent Application

Eric G. Laue, inventor (to NASA) Filed 9 Jun. 1971 13 p

(Contract NAS7-100)

(NASA-Case-NPO-11493; US-Patent-Appl-SN-151413) Avail: NTIS CSCL 14B

A thermopile for direct measurements of incident radiant energy is described. The thermopile includes a plurality of serially connected hemispherical arrays. A clamping shield separates the respective arrays. One thermocouple is used as a sensor to detect incident radiant energy while the other array serves as a thermal reference and is maintained at reference temperature. Electrical signals developed across a pair of output terminals provide a quantitative indication of incident radiant energy.

Author

N71-34389*# Massachusetts Inst. of Tech., Cambridge.

COMPACT SPECTRORADIOMETER Patent Application

Harold H. Seward, inventor (to NASA), Ian G. McWilliams, inventor (to NASA), and George A. Davidson, inventor (to NASA)

Filed 24 May 1971 14 p
(Contract NAS12-514)
(NASA-Case-HQN-10683; US-Patent-Appl-SN-146217) Avail: NTIS CSCL 14B

The development of a small spectroradiometer is discussed. The instrument consists of a pair of wedge filters and an array of silicon photovoltaic cells. Each cell provides an output which is a function of energy in a different wavelength band of light which is directed to the cell through the filters. The use of two identical wedge filters eliminates the adverse effects caused by pinholes in the filters. NASA

N71-34390# Japan Atomic Energy Research Inst., Tokyo.
JAERI NUCLEAR INSTRUMENT MODULE SYSTEM 7
Jan. 1971 70 p In JAPANESE; ENGLISH summary
(JAERI-Memo-4295) Avail: AEC Depository Libraries

Eight kinds of the JAERI nuclear instrument modules are described. General descriptions, specifications, circuits, and performance data for each unit are summarized. These units are Model 103 and Model 104 portable bin, Model 125 preamplifier, Model 147 read-out control, Model 155 pulse shape-to-height converter, Model 165 power supply, and Model 176 A and Model 176 B-mixer. Author (NSA)

N71-34391# Japan Atomic Energy Research Inst., Tokyo.
JAERI NUCLEAR INSTRUMENT MODULE SYSTEM 6
Jan. 1971 54 p In JAPANESE
(JAERI-Memo-4281) Avail: AEC Depository Libraries

Five kinds of JAERI nuclear instrument modules are described. General descriptions, specifications, circuit descriptions, and performance data for each unit are summarized. These units are Model 160 prescaler, Model 161 linear/log count-rate meter, model 162 microammeter, model 163 linear amplifier, and Model 171 decade attenuator. Author (NSA)

N71-34392# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
HIGH SENSITIVITY BERYLOMETER
R. Cervellati, P. Monaci, and S. Sircana 14 Sep. 1970 31 p refs
(RT/EL-(70)4) Avail: AEC Depository Libraries

The development of a beryllium analyzing instrument with a sensitivity of a few ppm is reported. It is based on the new but rather well known method of the neutron photoproduction. Two Sb-124 sources, having a nominal activity of 0.5 Ci each, irradiate a grinded mineral sample up to 1/2 kg in weight. Six BF3 tubes, connected in parallel and surrounded by paraffin, detect the neutrons. The background count rate is about 6 cpm. This value determines the minimum detectable mass of Be, which results 3.2 mg for a counting time of half an hour and a activity of 2 x 75 mCi. Such a mass correspond to a minimum detectable concentration of less than 10 ppm. At the highest activity of 2 x 700 mCi, the minimum detectable concentration is less than 1 ppm Be. The linearity of the instrument is good. Aging of the tubes has been observed after several months of operation and has been put in correlation quantitatively with the multiplication factor and the overall gamma irradiation of the tubes. Author (NSA)

N71-34393# Defence Standards Labs., Maribyrnong (Australia).
COMPRESSION CORRECTIONS FOR ACME THREAD GAUGES
K. N. Wise Nov. 1970 11 p refs
(TN-175) Avail: NTIS

Graphs and formula for compression correction for use in the measurement of Acme thread screw plug gages made from 1% carbon steel are presented. Author

N71-34394# Cranfield Inst. of Technology (England).
VORTEX RATE SENSOR
O. Brychta Dec. 1970 14 p refs
(Cranfield-M/P-2) Avail: NTIS

The characteristics of a vortex rate sensor are presented. The sensor is a fluidic device proposed for sensing small speeds of rotation. An expression for the gain of the vortex rate sensor is developed and compared with actual results. Some problems of practical uses of the vortex rate sensor are discussed. Author

N71-34395# Addis Translations International, Woodside, Calif.
PROTECTION OF STRAIN GAGES AND SEMICONDUCTOR TRANSDUCERS AGAINST MOISTURE [ZUM PROBLEM DES FEUCHTIGKEITSSCHUTZES VON DEHNUNGSMESSTREIFEN UND HALBLEITERGEBERN]
Goetz Andreae (Ph.D. Thesis - Carolo-Wilhelmina Tech. Univ., Brunswick, West Germany) Apr. 1971 283 p refs Transl. into ENGLISH from German Thesis Sponsored by AEC
(UCRL-Trans-10526) Avail: NTIS

Results of investigations into the problem of moisture protection of strain gages and semiconductor transducers are presented. Calculated and measured protection lifetimes are compared and differences between the two values are discussed. Author

N71-34396# Building Research Station, Watford (England).
A WIND-PRESSURE TRANSDUCER
J. R. Mayne May 1970 6 p refs Repr. from J. Phys. E: Sci. Instr., v. 3, 1970 p 248-250
(CP-17/70) Avail: Issuing Activity

A pressure transducer is described which was specially developed to measure wind pressures exerted on buildings. The instrument, which gives an electrical output, is suitable for measuring pressure in the range (+ or - 25 lb per square foot 2). The frequency response is such that pressure fluctuations lasting only 0.1 s can be recorded. Author

N71-34397# Joint Publications Research Service, Washington, D.C.
DESIGN AND BASIC CHARACTERISTICS OF BEARINGS FOR GYROSCOPIC DEVICES
M. P. Kovalev 23 Aug. 1971 62 p refs Transl. into ENGLISH from the book "Opory i Podvesy Giroskopicheskikh Ustroystv" Moscow, 1970 p 75-135
(JPRS-53883) Avail: NTIS

Longevity, moment of friction, rotational accuracy, accuracy of position, and stability of the established preload of ball bearings are examined in connection with the design of aerodynamic and aerostatic bearings. It is pointed out that in gyroscopic devices for aircraft, bearings are now being produced with clearances as fine as fractions of a micrometer. E.M.C.

N71-34398# Northeastern Univ., Boston, Mass.
PERFORMANCE OF LARGE PLASTIC SCINTILLATION COUNTERS AS PROTON SPECTROMETERS
B. Gottschalk and S. L. Kannenberg (Boston State College, Mass.) Aug. 1971 25 p refs
(Grants NSF GP-9217; NSF GP-25307)
(NUB-2093) Avail: NTIS

A large Pilot Y scintillation counter designed to measure proton energies to 215 MeV is described and results of tests on five identical units using a well-collimated monochromatic 160 MeV proton beam are presented. Light output is a relatively smooth function of distance from the photomultipliers, and can be fit to about 1 percent by a one-dimensional quadratic polynomial. The full-width at half-maximum (FWHM) line width for protons stopping by multiple Coulomb interactions is typically 1.8 percent and is shown to be due to photo-electron statistics. The energy calibration above 50 MeV can be represented by a linear function with non-zero intercept. Author

N71-34399# Joint Publications Research Service, Washington, D.C.
TELEPHOTOGRAPHS OF THE EARTH FROM SPACE

I. Bashilova 31 Aug. 1971 7 p Transl. into ENGLISH from Nauka Zhizn (USSR), no. 7, 1971 p 44-47
(JPRS-53949) Avail: NTIS

An overview is presented of the benefits that geologists have derived from space transmitted television photographs of the earth. It is pointed out that, in addition to the fact that they provide a tremendous field of view, the TV photographs from space have the property of a natural generalization of the objects which are being reflected. Numerous incidents are cited in which questions, relating to geological phenomena throughout the world, have been resolved through interpretation of space transmitted telephotos. D.L.G.

N71-34400# Fort Collins, Colo.
COLOR AERIAL PHOTOGRAPHY: A NEW VIEW FOR RANGE MANAGEMENT
Richard S. Driscoll Mar. 1971 15 p refs
(PB-199220; FSRP-RM-67) Avail: NTIS CSCL 02F

Shrubs such as antelope bitterbrush, big sagebrush, snowberry, and true mountain-mahogany can be identified more consistently on large-scale (1:600-1:1,200) color infrared aerial photographs than on the same scale color aerial photographs. Identification of relatively large forbs, including Fremont geranium and orange sneezeweed, is also easier on large scale color infrared. Neither film type appeared to give improved information regarding site delineation on smaller scale photographs. Other features of the range environment, including rodent disturbances, can best be identified on color infrared at photo scales up to 1:2,400. All of this depends on obtaining photographs at the right time of year in respect to phenology of the vegetation. Author (GRA)

N71-34401# Sandia Corp., Albuquerque, N. Mex.
ZERO-SHIFT IN PIEZOELECTRIC ACCELEROMETERS. POLARIZATION SWITCHING IN POLYCRYSTALLINE FERROELECTRICS AT VERY LOW FIELDS AND STRESSES
Ralph H. Plumlee Mar. 1971 61 p refs Sponsored by AEC
(SC-RR-70-755) Avail: NTIS

Zero-shift is shown to be inherent in polycrystalline ferroelectrics as a polarization switching process occurring at low stress (less than 100 psi shear) and low field (50 - 500 V/cm). Remanence polarization reorientations amount to less than 0.0001 of the saturation remanence polarization and require switching energies less than 1% of typical maximum mechanical energy depositions. Mechanical stress is quite adequate to cause polarization switching which relaxes slowly and incompletely following passage of the stress wave. Open-circuit piezoelectrically generated fields are also adequate to produce the polarization switching. Shear stress in shear-type accelerometers produces positive zero-shift (same sign as piezoelectric output) whereas the piezoelectricity generated field produces negative zero shift. The latter is largely avoidable by capacitive attenuation of the piezoelectric voltage to near short-circuit usage. All the polycrystalline ferroelectrics tested appear to undergo one or more sluggish, low-energy, reversible transitions that are enforced by electric fields in the range 100 - 1000 V/cm. The associated changes in remanence polarization are 1000 - 4000 pC/cm2. Author

N71-34402# Institute of Nuclear Physics, Krakow (Poland).
A UNIVERSAL, HIGH STABILITY RADIOIONIZING DETECTOR FOR GAS CHROMATOGRAPHY [UNIWERSALNY, WYSOKOSTABILNY RADIOJONIZACYJNY DETEKTOR DLA CHROMATOGRAFII GAZOWEJ]
J. Lasa 1970 14 p refs ENGLISH summary
(INP-737) Avail: AEC Depository Libraries

The basic parameters characterizing the construction of a new detector, model DNW, are presented. This detector can be used as a cross section detector, model DNW-100, an argon detector, model DNW-200, or as an electron capture type detector, model DNW-300. Nickel-63 was used as the ionizing source in the detector. The detector can work at temperatures up to 400. Author (NSA)

N71-34403# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
TECHNOLOGICAL CONSIDERATIONS IN EMERGENCY INSTRUMENTATION PREPAREDNESS. PHASE 1: CURRENT CAPABILITIES SURVEY
J. M. Selby and C. M. Unruh Jan. 1971 83 p
(Contract AT(45-1)-1830)
(BNWL-1552) Avail: NTIS

The radiological emergency instrumentation currently in place at a selected number of contractor and private nuclear facilities was reviewed. Some twelve power reactors, eleven AEC sites, four test reactors, three research reactors, two fuel reprocessing plants, and one plutonium fuel fabrication plant were included in the survey. Much of the instrumentation observed was designed and installed primarily for use in routine monitoring operations and was applicable only for the measurement of normally anticipated releases of radioactive materials. Deficiencies in emergency instrumentation were principally attributable to inadequately designed instrumentation, improper installation, inadequate calibrations or limited response ranges. All nuclear facilities need performance criteria for radiological emergency instrumentation to provide a sound basis to define the specific needs for and to evaluate the adequacy of such instrumentation. Author (NSA)

N71-34404*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MEASUREMENTS OF TOTAL HEMISPHERICAL EMITTANCE FOR CHROMEL AND FOR ALUMEL WIRES
William D. Harvey, Lemuel E. Forrest, and Frank L. Clark Washington Sep. 1971 10 p refs
(NASA-TM-X-2359; L-7645) Avail: NTIS CSCL 14B

The total hemispherical emittance for chromel and alumel thermocouple wires has been measured over the approximate temperature range 556 K to 1333 K and at two representative surface conditions. If wire oxidation is suppressed by maintaining essentially an inert-gas test environment, the magnitude of emittance for a chromel and for an alumel wire remains relatively low compared with that for a more severely oxidized wire. Also, emittance increases less for alumel than for chromel wires for a change from a bright to an oxidized wire under comparable environmental conditions. The present results indicate that emittance values strongly depend upon wire surface conditions. Author

N71-34405*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SENSOR FOR DETECTING METEOROID PENETRATION OF PRESSURIZED CELLS
Leonard R. Mc Master Washington Sep. 1971 31 p refs
(NASA-TN-D-6447; L-7794) Avail: NTIS CSCL 14B

An experimental investigation was made to determine the feasibility of using a cold-cathode glow discharge tube to detect the meteoroid puncture of pressurized cells. By using various electrode configurations, electrode materials and ionizing gas compositions, several glow discharge tubes were constructed and tested to determine a combination that would give operational characteristics suitable for this purpose. It was demonstrated that this device would operate like a switch, conducting current only when a particular pressure range was reached during the depressurization of a punctured cell. In addition, the time rate of change of current during a discharge was found to very proportionally with the leak rate, and thereby puncture size could be determined. Particularly advantageous is the more than 80 times reduction in weight of this sensor compared with the presently used diaphragm-actuated microswitch. Author

N71-34406# Technische Hochschule Munchen (West Germany).
PROBLEMS AND REALIZATION OF A NEW INFRARED RADIATION DETECTOR FOR GAS CHROMATOGRAPHY

[PROBLEMATIK UND VERWIRKLICHUNG EINES NEUEN INFRAROT-STRAHLUNGSDETEKTORS FUER DIE GAS-CHROMATOGRAPHIE]
Josef Heinfling (Ph.D. Thesis) 1970 20 p refs In GERMAN
Avail: NTIS

An infrared emissivity detector for gas chromatography is developed and used to analyze combustible organic substances. The instrument utilizes spectral filters to eliminate basic radiations of the pure flame so that only burning additive organic substances are received by its detector. An example of infrared spectrum analysis on organic substances burning within an oxygen-hydrogen flame is included. Transl. by G.G.

N71-34407# Royal Inst. of Tech., Stockholm (Sweden).
SUSCEPTIBILITY MEASURING DEVICE FOR THE FOLLOWING OF A MARTENSITIC TRANSFORMATION DURING TENSILE TESTING
V. Kelha and T. Niinikoski 1971 19 p refs
(PB-199761; APS-PH-76) Avail: NTIS CSCL 14B

The paper presents a method by which it is possible to follow the martensitic transformation occurring in a copper-rich copper-iron alloy during tensile testing using the continuous measurement of magnetic susceptibility. The device consists of two identical coil sets, which are used in an ac bridge circuit, between which is inserted a cylindrical bar specimen. The signal of the bridge has been calculated as a function of the susceptibility and the conductivity of the specimen. The accuracy and the reproducibility of the results is 5%. Author (GRA)

N71-34408 Royal Observatory, Edinburgh (Scotland). Science Research Council.
AUTOMATED SPECTROPHOTOMETRY, 2
G. I. Thompson 1971 51 p refs *Its* Publ. v. 7, no. 2
Copyright. Avail: Issuing Activity

A computer program was developed for the reduction of digitized stellar spectra. The spectrum is first convoluted with a function designed to filter out the low spatial frequencies. If it is possible to analyze the spectrum sharply into two classes of objects, those of high frequency (lines) and those of low frequency (continuum, absorption bands, wide wings, etc), this process allows the two to be treated separately. It is possible to measure line positions at least as well as by hand. If it may be assumed that all lines have the same profile, that the blending is linear, and that the profile is known, it is possible to determine line intensities. It is possible to determine the profile if the first two conditions are met. The program was applied to 81 spectra of 21 Fv and Gv type stars, 5400-6600A, at 15A/mm. The dispersion ensures that the line profile is dominated by the instrument so that the conditions apply. A table of equivalent widths and associated standard errors is presented. The measured line widths show a clear correlation with star, which suggests that rotational velocity is a contributor. Author

N71-34409 National Lending Library for Science and Technology, Boston Spa (England).
TOWARD THE SUN
V. Krat 13 Apr. 1971 5 p Transl. into ENGLISH from the Russian report
(NLL-M-20418-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The advantages of a stratospheric observatory using Cassegrainian telescopes to obtain direct solar photographs as well as spectrograms are outlined. E.M.C.

N71-34410 National Lending Library for Science and Technology, Boston Spa (England).
PRECISION AND ACCURACY IN QUANTITATIVE GAS CHROMATOGRAPHY
R. Kaiser 16 Jun. 1971 21 p refs Transl. into ENGLISH from Method. Phys. Anal. (France), v. 5, no. 4, Dec. 1969 p 357-389
(NLL-CE-Trans-5638-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Gas phase chromatography is dicussed from the standpoint that it is becoming the most precise instrumental method possessed in the whole field of analytical chemistry, yet it remains the only method with which it is possible to reproduce with a high degree of analytical precision a result which is absolutely false, both in qualitative and quantitative terms. The discussion emphasizes the need for development of suitable methods to assess the precision of an analysis, to recognize and measure the systematic errors, to evaluate the detectors, amplifiers, and recording apparatus for quantitative measurements, to make more accurate use of chromatograms, and to recognize the weaknesses in equipment systems. D.L.G.

N71-34411 Florida State Univ., Tallahassee.
THE DESIGN AND OPERATION OF A HIGH RESOLUTION NEAR INFRARED SPECTROMETER
Charles William Robertson, Jr. (Ph.D. Thesis) 1969 78 p
Avail: Univ. Microfilms Order No. 70-16347

The details of the design and construction of a three meter Littrow vacuum spectrometer for the near infrared from one to six microns wavelength are discussed. The instrument can be operated as a two or four pass spectrometer. The effects of the optical path on image curvature for both two and four pass operation and the spherical aberration of an off-axis collimating mirror are examined. The problem of grating support and drive is discussed along with the general mechanical considerations of the instrument. Dissert. Abstr.

N71-34412 Colorado Univ., Boulder.
AN ELECTRON TRANSPORT SOLENOID-Si-(Li) DETECTOR SPECTROMETER AND ON-LINE CONVERSION ELECTRON AND GAMMA-RAY SPECTROSCOPY
Benno Ernst Klank (Ph.D. Thesis) 1969 175 p
Avail: Univ. Microfilms Order No. 70-16497

An internal conversion electron spectrometer incorporating a solenoidal magnetic field along the target-detector axis for transporting electrons from a target placed in a cyclotron beam to a liquid nitrogen cooled Si(Li) detector has been constructed and successfully operated in experimental nuclear structure research. A time-varying magnetic field is employed to avoid fluctuations of the electron transmission for different energies, and the time-averaged value of the magnetic induction is approximately 5500 gauss. For a 0.9 cm diameter detector 54 cm away from the target the measured solid angle of electrons collected on the detector face is 45 percent, 22 percent and 9 percent of 2 pi for 100 keV, 500 KeV and 1500 KeV electrons respectively. During work with radioactive sources and during on-line experiments an energy resolution of approximately 3 KeV FWHM has been obtained for electron lines over a wide range of energies. Dissert. Abstr.

N71-35035*# Honeywell, Inc., St. Paul, Minn.
AIR DATA SENSING FOR SPACE SHUTTLE Interim Report
Delroy J. Sowada, Frederich A. Moynihan, Ronald G. Bailey, and Alex Hafner (NASA. Marshall Space Flight Center) *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 3-36 3 Vol. (See N71-35034 21-31)
(Contract NAS8-26326)
Avail: NTIS CSCL 22B

N71-35038*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SHUTTLE SENSORS
Vernon C. Melliff, Jr. and Arthur T. Linton (Boeing Co., Houston, Tex.) *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 73-104 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-34316# Joint Publications Research Service, Washington, D.C.
EVALUATION OF DISTURBING ACCELERATIONS AND TILTS ON THE READINGS OF A GYROSTABILIZED MARINE GRAVIMETER
V. S. Kutepov et al *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 24-40 refs (See N71-34313 21-13)
Avail: NTIS

N71-34317# Joint Publications Research Service, Washington, D.C.
A MARINE GRAVIMETER WITH A CODING DEVICE
V. A. Tulin *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 41-48 refs (See N71-34313 21-13)
Avail: NTIS

N71-34318# Joint Publications Research Service, Washington, D.C.
A MARINE GRAVIMETER WITH AUTOMATIC READOUT
V. A. Tulin et al *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 49-59 refs (See N71-34313 21-13)
Avail: NTIS

N71-34319# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF THE ACCURACY OF THE GAL-OMPO-2 GRAVIMETER
V. A. Tulin et al *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 60-75 refs (See N71-34313 21-13)
Avail: NTIS

N71-34320# Joint Publications Research Service, Washington, D.C.
THE RUG INSTRUMENT FOR RECORDING ACCELERATIONS AND TILTS
Ye. I. Popov et al *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 76-84 (See N71-34313 21-13)
Avail: NTIS

N71-34321# Joint Publications Research Service, Washington, D.C.
GYROSTABILIZED PLATFORMS FOR STABILIZATION OF GRAVIMETERS AND THEIR EXPERIMENTAL TESTING
V. K. Karpov *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 85-103 refs (See N71-34313 21-13)
Avail: NTIS

N71-34322# Joint Publications Research Service, Washington, D.C.
INVESTIGATION OF THE DYNAMICS OF GYROSTABILIZED PLATFORMS WITH PENDULUM CORRECTION, INTENDED FOR THE STABILIZATION OF GRAVIMETRIC APPARATUS
V. K. Karpov et al *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 104-118 refs (See N71-34313 21-13)
Avail: NTIS

N71-34323# Joint Publications Research Service, Washington, D.C.
SOME RESULTS OF AN INVESTIGATION OF GYROSTABILIZED PLATFORMS
V. S. Kutepov *In its* Equipment and Methods for Marine Meas. of the Force of Gravity 18 Aug. 1971 p 119-126 refs (See N71-34313 21-13)
Avail: NTIS

N71-34130*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL PERIOD DETECTOR OSCILLOSCOPE TRIGGER
W. A. Lushbaugh *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 79-83 ref (See N71-34118 21-07)
Avail: NTIS

N71-34135*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
IMPROVED RF CALIBRATION TECHNIQUES: SYSTEM OPERATING NOISE TEMPERATURE CALIBRATIONS
M. S. Reid *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 105-109 ref (See N71-34118 21-07)
Avail: NTIS CSCL 14B

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-34413*# Wyoming Univ., Laramie. Natural Resources Research Inst.
ENVIRONMENTAL ASPECTS OF THE UNITS PROBLEM
John C. Bellamy Feb. 1971 33 p refs *Its* Information Circular no. 68
(Grant NGR-51-001-001)
(NASA-CR-121659) Avail: NTIS CSCL 13I

The metric system of units is seen to have evolved into the International System of Units more to provide for precise quantitative comparisons of the physical qualities of different things than to interrelate the several different kinds of physical qualities of particular one unit-things. In contrast, the customary units of angle and time and the nautical mile are seen to have evolved to provide for identifying and coordinating particular one space-time positions in and of our earthly environment with nominal numbers of ideally defined unified units of their several different kinds of physical qualities. The so-called English units are similarly seen to have evolved primarily to identify particular one unit-things in familiarly useful relationship to everyone's own personal measures of things - to happen to be more conveniently related to widely useful subdivisions of the earth than the metric units - and therefore might now very well evolve into an integrally-related part of a newly conceived Geospheric System of Units for coordinating human activities with respect to characteristic features of our earth-centered or Geospheric environment. Author

N71-34414*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
PARAMETER UNCERTAINTIES IN CONTROL SYSTEM DESIGN
Thorgeir Palsson (Ph.D. Thesis) May 1971 293 p refs
(Grants NGR-22-009-229; NGR-22-000-548)
(NASA-CR-116774; TE-48) Avail: NTIS CSCL 13I

A design method is developed for including the effects of parameter uncertainties in the design of linear control systems. The approach taken to this problem may be classified as a special case of the stochastic control problem. Thus, the formulation is based on the minimization of the expected value of a quadratic performance index defined in terms of the system state vector. The uncertainty in the value of the performance

index is then the result of the statistical nature of the system parameters rather than a random input signal. It is shown that the expected value of the performance index may be written as a sum of two terms under the assumption of first order variations of the system state. The key to the numerical solution of this problem lies in using the phase-variable form of the system equations. Very efficient numerical techniques are developed for obtaining this solution using a gradient algorithm. The method is finally applied, with considerable success, to the design of two flight control systems. Author

N71-34415*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RELIABILITY TESTING AND DEMONSTRATION OF AERO SPACE PROBLEMS
Vincent R. Lalli 1971 86 p refs Proposed for Presentation at 9th Ann. Reliability Eng. and Management Inst., Tucson, Ariz., 9-13 Nov. 1971; sponsored by Arizona Univ.
(NASA-TM-X-67877; E-5300-1) Avail: NTIS CSCL 14D

Aerospace problems are described which were solved using distribution functions, sampling, and accelerated life testing as reliability methodologies. E.M.C.

N71-34416*# California Univ., Santa Barbara. Solid State Lab.
PROFILING PROCEDURES. 1: ANODIC OXIDATION. OLS PROFILE PROGRAM
Hormoz M. Motamedi 1971 38 p Original Contains Color Illustrations
(Grant NGR-05-010-041)
(NASA-CR-119799) Avail: NTIS CSCL 13H

Instructions are given for use of anodic oxidation apparatus in conjunction with OLS-PROFILE-PROGRAM to obtain electrically active concentration profiles of doped silicon wafers. Author

N71-34417*# Marquardt Corp., Van Nuys, Calif.
TEST REPORT: EVALUATION OF DU PONT LRU 488 AS A SEAT SEAL MATERIAL IN THE MARQUARDT R4D ENGINE VALVE
R. Lynch Jan. 1971 17 p Prepared for JPL
(Contract NAS7-100)
(NASA-CR-121716; S-991) Avail: NTIS CSCL 11A

The suitability of DuPont LRU 488 molded elastomeric Teflon as a seat seal material for the R4D valve was assessed. The seat assemblies were subjected to a test program intended to evaluate leakage characteristics as a function of cycle life and temperature. The results of that test program are reported. Author

N71-34418*# Sandia Labs., Albuquerque, N. Mex.
CHECKLIST OF GOOD CONTAMINATION CONTROL PRACTICES FROM A MANUFACTURING VIEWPOINT
Douglas W. Ballard Apr. 1971 40 p refs Sponsored in part by AEC
(Contract NSR-09-010-027)
(NASA-CR-121740; SC-M-70-549) Avail: NTIS CSCL 13H

Contamination control problems continue to plague manufacturing facilities engaged in the production of high reliability precision components and assemblies. While the designer bears some responsibility for the problems, many of the problems can be attributed to poorly planned and executed manufacturing practices. Good contamination control practices in nine critical manufacturing areas are highlighted. The checklists, based on years of trouble-shooting experience, contain 131 recommendations that have proven effective in minimizing contamination problems. Author

N71-34419*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTROLYTIC GAS OPERATED ACTUATER Patent Application
Peter G. Simmonds, inventor (to NASA) Filed 29 Mar. 1971 17 p
(Contract NAS7-100)
(NASA-Case-NPO-11369; US-Patent-Appl-SN-129072) Avail: NTIS CSCL 13I

The development of an electrolytic gas generator-evacuator which eliminates the need for heavy gas storage cylinders and associated regulating and metering equipment is discussed. The actuator of the device is a closed system and the drive gas is continuously regenerated and returned to the actuator during an expansion mode of operation. NASA

N71-34420*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ELECTRIC MOTIVE MACHINE INCLUDING MAGNETIC BEARING Patent Application
Philip A. Studer, inventor (to NASA) Filed 8 Jan. 1971 18 p
(NASA-Case-XGS-07805; US-Patent-Appl-SN-104884) Avail: NTIS CSCL 13I

A dc motor is described which includes a plurality of stationary field windings and a stationary armature winding. Magnetic fluxes derived from the field windings interact with currents in the armature winding to produce a torque that rotatably drives a rotor about an axis that has a tendency to coincide with a common longitudinal axis for the armature and field windings. The displacement of the rotor axis relative to the common axis is sensed to provide a signal for controlling the currents in the field windings. The currents in the field windings displace the rotor so that the rotor axis has a tendency to coincide with the common axis. The rotor is thereby magnetically suspended, without mechanical or air bearings, by the same forces that rotate it. To maintain the rotor at a constant speed, the total current in the field windings is maintained constant. NASA

N71-34421*# Bendix Corp., Teterboro, N.J.
EVACUATION VALVE Patent Application
Burton W. Roney, inventor (to NASA) Filed 5 Jan. 1971 8 p
(Contract NAS1-5012)
(NASA-Case-LAR-10061-1; US-Patent-Appl-SN-104047) Avail: NTIS CSCL 13K

A peckless valve is described for use with an evacuation chamber with a quick reaction, single-throw, open-closed control and a quick-connect adapter for attachment to a vacuum line and a vacuum pump. A bellows connecting the valve head to the valve casing seals off the seating mechanism from any connect with fluid flowing through the valve. The bellows and a spring act to hold the valve head in a seated position. A ball and socket joint connects the valve stem to the valve head. The valve head is free to swivel as it is seated producing an automatic valve alinement and a better valve seal. An O-ring fitted in a groove in the valve head also serves to seal the valve head in the seat. A two-position cam lever moves the valve stem through a self-lubricating bushing to open and close the valve. NASA

N71-34422*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
FASTENER STRETCHER Patent Application
Joseph W. O'Connor, inventor (to NASA) and Victor C. Orem, inventor (to NASA) Filed 9 Apr. 1971 23 p
(NASA-Case-GSC-11149-1; US-Patent-Appl-SN-132849) Avail: NTIS CSCL 13E

A fastener stretcher for applying a substantially pure axial tensile force to a structural bolt or similar fastening element, comprising a pair of telescoping elements one of which is temporarily secured to the bolt, is described. By spreading the telescoping elements axially, the bolt is tensioned axially to permit a nut or the like to be threaded with a minimum of torque; when the elements are then removed from the bolt, the axial forces on the bolt are taken up by the nut to retain the bolt in its stressed state. NASA

N71-34423*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THERMAL COMPENSATING STRUCTURAL MEMBER Patent Application
Robert R. Below, inventor (to NASA) Filed 12 Feb. 1971 13 p
(NASA-Case-MFS-20433; US-Patent-Appl-SN-114847) Avail: NTIS CSCL 13I

A structural member that remains near a constant length when subjected to varying thermal loads is described. The structure includes an outer bimetallic housing composed of inner and outer concentrically spaced casings attached to one another at one of their ends and left free to expand and contract at the other. The casings are made of materials having different coefficients of expansion and therefore their lengths will vary with respect to one another as their thermal environment changes. A compensator strut is slidably mounted in the outer housing. A compensating drive linkage mounted on the free ends of the inner and outer casings so as to be rotated by relative movement between the casings is connected to the strut and causes sliding movement thereof to maintain the structure at a constant length when the components thereof change lengths due to expansion and contraction. NASA

N71-34424*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
WELDING BLADES TO ROTORS Patent Application
Kenneth H. Holko, inventor (to NASA) and Thomas J. Moore, inventor (to NASA) Filed 16 Apr. 1971 12 p
(NASA-Case-LEW-10533-1; US-Patent-Appl-SN-134658) Avail: NTIS CSCL 13H

A method using magnetic force upset welding to form T-joints between dissimilar thickness parts is described. This type of resistance welding is used to join compressor and turbine parts thereby reducing the weight and cost of a jet engine. NASA

N71-34425*# Boeing Co., Seattle, Wash.
METHOD OF HYDROSTATICALLY EXTRUDING REFRACTORY MATERIALS Patent Application
James G. Hunt, inventor (to NASA) and Roy W. Rice, inventor (to NASA) Filed 29 Mar. 1971 17 p
(Contract NAS7-276)
(NASA-Case-NPO-10811; US-Patent-Appl-SN-129074) Avail: NTIS CSCL 13H

A method of hydrostatically extruding refractory materials is discussed. The method is characterized by embedding the refractory material within the body of a solid substance, softer than the material, to provide an extrusion unit or hydrostatic fluid. Extreme temperature and pressure are then applied to the materials thus completing the process. NASA

N71-34426*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
REDUNDANT HYDRAULIC CONTROL SYSTEM FOR ACTUATORS Patent Application
Richard A. Campbell, inventor (to NASA) Filed 1 Jun. 1971 14 p
(NASA-Case-MFS-20944; US-Patent-Appl-SN-148756) Avail: NTIS CSCL 13K

A hydraulic control system which will remain operative even if one or two major elements should fail is discussed. A combination of three main valves to supply hydraulic pressure to a conduit pattern including four secondary valves for the assured operation of a hydraulic actuator is provided. All the secondary valves are under the command of a comparator and logic controller which is capable of stopping the hydraulic fluid flow to the valve that failed and permitting hydraulic flow to continue with the other operative valves. NASA

N71-34427*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROCESSES FOR MAKING SHEETS WITH PARALLEL PORES OF UNIFORM SIZE Patent Application
Joseph M. Sherfey, inventor (to NASA) Filed 24 Mar. 1971 20 p
(NASA-Case-GSC-10984-1; US-Patent-Appl-SN-127490) Avail: NTIS CSCL 13H

Alternate processes are described for creating metal sheets or plaques having small, parallel pores of uniform size. A wide variety of metallic powders may be utilized by the processes in combination with a wide variety of filaments, depending upon the desired nature of the resultant sheet or plaque. The commercial availability of the filaments in small sizes make the processes practical for inducing very small uniform holes in the sheets. In addition to induced pores, interstitial pores may be accomplished by limiting the compacting step. The processes are considered to be useful in the production of plaques to form battery electrodes, and to produce sieves requiring uniform pores of a small size. D.L.G.

N71-34428*# Boeing Co., Seattle, Wash.
EXTRUSION CAN Patent Application
James G. Hunt, inventor (to NASA) and Roy W. Rice, inventor (to NASA) Filed 29 Mar. 1971 15 p
(Contract NAS7-276)
(NASA-Case-NPO-10812; US-Patent-Appl-SN-129073) Avail: NTIS CSCL 13I

A tubular wall extrusion can is described for use in extruding ceramics under heat and pressure. The can includes a cylindrical, metallic body formed of numerous elongated sections and is adapted to receive a ceramic billet to be co-extruded with the can. The sections are delineated by a number of parallel slots filled with a material which precludes welding of the adjacent surfaces during co-extrusion of the can and billet. D.L.G.

N71-34429# Cranfield Inst. of Technology (England).
A MATHEMATICAL INVESTIGATION INTO OPTIMAL FITS AND TOLERANCES OF HYDRODYNAMICALLY LUBRICATED JOURNAL BEARINGS
E. Kay Feb. 1971 28 p refs
(Cranfield-M/P-3) Avail: NTIS

The problem of calculating the clearance for hydrodynamically lubricated journal bearings which maximizes the minimum oil film thickness for given operating conditions is discussed. The use of Sommerfield numbers, obtained from the numerical solution of Reynold's equation for a finite three-dimensional bearing is described. The effect of tolerances on the maximand is derived mathematically and numerical tolerance limits are established. The suitability of this method for general optimization of bearing performance is discussed. Author

N71-34430# California Univ., Los Angeles. Lab. of Nuclear Medicine and Radiation Biology.
IMPROVED FEEDBACK CONTROL FOR THE NULL-POINT COMPENSATING SYSTEM
H. M. Mork, R. W. Farmer, and K. A. Flygare Mar. 1971 22 p refs
(Contract AT(04-1)-gen-12)
(UCLA-12-813) Avail: NTIS

A proportional feedback control has been designed to replace the original servo control unit in the Null-point compensating system developed by Keller. It consists of two almost identical channels, one controlling CO2 concentration and the other controlling relative humidity. The improved feedback mechanism increased the stability of the system significantly more than the original servo control unit and enabled it to maintain constant atmospheric composition in the assimilation chamber under normal conditions. Other modifications to the system improved both the response time and the stability. Author

N71-34431# Addis Translations International, Woodside, Calif.
MACHINING WITH A PLASMA JET
G. Spur (Tech. Univ., Berlin, West Germany) et al Mar. 1971

15 p refs Transl. into ENGLISH from CIRP, Ann. Int. Inst. Prod. Eng. Res. (England), v. 18, 1970 p 81.1-81.8 Sponsored by AEC
(UCRL-Trans-10524) Avail: NTIS

Results are presented of research conducted on a method for producing circular cylindrical surfaces by plasma machining on a lathe. After investigating the optimal adjustment of the plasma torch to the workpiece, a description of the technological possibilities of the procedure is given. In addition to the geometrical data, the gas flow rate and the kinematical data are given. A comparison with conventional machining by turning makes it possible to state the efficiency of the plasma machining process. Finally, results of investigations are given showing the influence on the structure of the machined material. Author

N71-34432*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMOMECHANICAL PROCESSING OF THE NICKEL-BASE ALLOY U-700
Charles P. Blankenship and Charles A. Gyorgak Washington Sep. 1971 16 p refs
(NASA-TN-D-6418; E-6372) Avail: NTIS CSCL 13H

Thermomechanical processing (TMP) greatly improved the yield strength and stress-rupture life of the alloy. At 650 C (1200 F), the best TMP schedule gave about a 3700-hr rupture life at a stress of 827 MN/m sq. (120 ksi). With a conventional heat treatment, the rupture life was about 400 hr under similar test conditions. The TMP increased the yield strength of the alloy by at least 50 percent at temperatures of 540 to 760 C (1000 to 1400 F). The tensile ductility (elongation) of the alloy was reduced from about 35 percent to about 5 to 15 percent.
Author

N71-34433*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELEMENTAL ANALYSIS OF A FRICTION AND WEAR SURFACE DURING SLIDING USING AUGER SPECTROSCOPY
Donald H. Buckley and Stephen V. Pepper Washington Sep. 1971 19 p refs
(NASA-TN-D-6497; E-6428) Avail: NTIS CSCL 13I

A friction and wear apparatus incorporating an Auger cylindrical mirror spectrometer has been constructed. The spectrometer in the apparatus provides the capability of analyzing for all elements heavier than helium present on the sliding friction and wear surface of interest in 0.10 sec. Adhesion and transfer of silver, aluminum, and copper to a steel surface were monitored while transfer was occurring. Variations in transfer mode could be detected. Adsorption of gases containing oxygen to a copper transfer film and subsequent friction-initiated desorption of that film were monitored with the Auger spectrometer. The Auger cylindrical mirror spectrometer affords the friction, wear, and lubrication researcher a tool and capabilities heretofore unavailable. Author

N71-34434# National Bureau of Standards, Washington, D.C.
A METRIC AMERICA: A DECISION WHOSE TIME HAS COME: US METRIC STUDY
Jul. 1971 192 p refs
(NBS-Sp-345) Avail: SOD $2.25

The results of a study to evaluate the impact on the United States of the metric trend are presented. Arguments pro and con from the early days of the Republic are outlined, and the meaning of going metric is discussed with respect to the time period, industry, education, US relations with the rest of the world using the metric system, and the antitrust law. The benefits and costs are considered, and the methods taken by Japan and Great Britain (unplanned and planned, respectively) are described. It is concluded that the US will eventually change to the metric system. The bases for this conclusion are that the US is already metric in some respects and is becoming more so, and that the great majority of businessmen, educators, and other informed persons participating in the study reported that increased use of the metric system is in the best interests of the country. It is recommended that the nation change to metric under a coordinated program providing for flexibility and encouraging sectors of society to deal with their problems voluntarily. N.E.N.

N71-34435# Sandia Corp., Albuquerque, N. Mex.
EXPLOSION-LIKE PROCESSES DURING THE PULSED TREATMENT OF MATERIALS BY AN ELECTRON BEAM
D. A. Noskov and N. G. Pankovets 1970 12 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (USSR), no. 4, 1970 p 16-20
(SC-T-71-3017) Avail: NTIS

Results are presented of observations on the processes of the expulsion of matter during an intense pulsed bombardment of solid bodies. The expulsion of substance from the influence of the beam possesses an explosion-like character in a number of instances. In the majority of metals, one observed phenomena of thermal explosions whose action ejected the metal from the contact point of the beam; whereby the ejection of the surface material occurs in the form of tiny droplets. Explosion-like processes during the bombardment of diamonds, glass, and ceramics are described. Author (NSA)

N71-34436# Ohio State Univ., Columbus. Engineering Experiment Station.
DEVELOPMENT OF SONIC AND ULTRASONIC POWER DEVICES FOR APPLICATION IN HIGHWAY ENGINEERING, VOLUME 2 Final Report
Robert C. McMaster, Karl F. Graff, Berndt B. Dettloff, and Hildegard M. Minchenko Aug. 1970 615 p refs
(PB-199111; EES-220-Vol-2) Avail: NTIS CSCL 13C

The major components in a sonic system consist of the transducer, the work surface, coupling means for transferring energy from the transducer to the work, the electrical power supply and the structure necessary to bring the transducer in contact with the work. The areas of study reported pertain to these various components and the interactions between them. The material logically divides into four major headings: transducers and systems, transmission lines, impact coupling, and sonic energy effects on soil and rock. GRA

N71-34437# Ohio State Univ., Columbus. Engineering Experiment Station.
DEVELOPMENT OF SONIC AND ULTRASONIC POWER DEVICES FOR APPLICATION IN HIGHWAY ENGINEERING, VOLUME 1 Final Report
Robert C. McMaster, Charles C. Libby, and Kark Graff Aug. 1970 218 p refs Sponsored by DOT
(PB-199110; EES-220-1-Vol-1) Avail: NTIS CSCL 13C

The development of practical sonic systems for highway engineering applications included four major areas for engineering design. The types of equipment involved included: (1) electrical power supplies to drive sonic energy generators or transducers, (2) sonic generators which convert electric input energy into vibrational output energy, (3) energy transfer mechanisms to couple the vibrational sonic energy from the transducers to the tools and work surfaces, and (4) tools, specifically designed for the application of sonic energy to highway oriented processes. GRA

N71-34438# Bendix Corp., Kansas City, Mo.
ALUMINUM PULSE-ARC WELDING Final Report
D. L. Hollar Mar. 1971 21 p
(Contract AT(29-1)-613)
(BDX-613-321) Avail: NTIS

Experiments designed to determine the origin of the necking problem during welding of aluminum wires indicated that an oxide coating on the aluminum wire might be the cause of that problem. Preheating and post-heating of the cover gas, weld fixture, and piece part did not reduce the necking problem, but tended to make it more severe. A current-viewing-resistor (CVR)

method of monitoring the weld current during the welding process provided an effective, nondestructive means of ensuring weld quality. Surface finish and the method employed in finishing the tungsten electrodes were shown to have significant effects upon electrode life and consistency of performance.
Author

N71-34133*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DETECTION OF FAILURE RATE INCREASES
G. Lorden (Calif. Inst. of Tech.) and I. Eisenberger *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 95-100 refs
(See N71-34118 21-07)
Avail: NTIS CSCL 14D

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-34439*# Michigan Univ., Ann Arbor. High Altitude Engineering Lab.
MANDEL'SHTAM-BRILLOUIN SCATTERING OF CO2 LASER LIGHT FROM THE ATMOSPHERE AS A REMOTE SENSING PROBE
Anders Daniels Jan. 1971 103 p refs
(Grant NGR-23-005-452)
(NASA-CR-121863; TR-004780-1-T) Avail: NTIS CSCL 20E

Scattering of 10 micro CO2 laser light in the atmosphere is discussed. Since the wavelength of this laser light is much longer than the mean free path of the molecules (STP), the radiation will no longer be scattered by individual molecules but rather by larger random density inhomogeneities. The corresponding pressure fluctuations move with the speed of sound and the return signal will therefore exhibit a net shift proportional to the sound velocity which in turn will be indicative of the temperature of the air. The return signal will furthermore exhibit a broadening inversely proportional to the density of the media. Thus by determining the spectral profile and frequency of the backscattered light one should be able to establish the temperature and density of the air without knowing the total return signal, which has been required in earlier remote atmospheric sensing investigations.
Author

N71-34440*# Massachusetts Inst. of Tech., Cambridge. Dept. of Physics.
OPTICAL AND INFRARED MASERS Semiannual Progress Report, 1 Oct. 1970 - 31 Mar. 1971
21 May 1971 151 p refs
(Grant NGL-22-009-012; MIT Proj. DSR-76148)
(NASA-CR-121728; SASR-16) Avail: NTIS CSCL 20E

High resolution studies of atoms and molecules, molecular excitation and relaxation mechanisms, short pulse experiments, and laser harmonic frequency mixing are summarized. Fluorescence induced by coherent optical pulses was observed, along with intense superradiant emission in the high gain infrared transitions of HF and DF molecules.
Author

N71-34441*# Illinois Univ., Urbana. Antenna Lab.
THE EFFECT OF COHERENCE AND MULTIPLE SCATTERING ON LASER RADAR AIR POLLUTION MEASUREMENTS
H. C. Sievering and R. Mittra Jun. 1971 176 p refs
(Grant NGR-14-005-009)
(NASA-CR-121873; Rept-71-5; SR-16; UILU-ENG-71-2544) Avail: NTIS CSCL 20E

A review of the remote sensing field with applications to air quality monitoring was conducted. It is concluded that laser radar is the most promising remote sensing device for the broadest range of air pollution measurements. A radar equation taking account of dependent scattering as related to laser coherence properties is determined. The effect of multiple scattering on laser radar pulse distortion is calculated by a Monte Carlo technique for all orders of multiple scattering. Multiple scattering effects cause many more photons to be entirely lost from the beam long before pulse distortion occurs. However, the most important conclusion of this work is that dependent scattering may be observed with appropriate laser radar system parameters and that operation in a coherent and an incoherent mode of operation can allow for discrimination of the backscatter signal by pollutant particulates and molecular constituents.
Author

N71-34442*# National Aeronautics and Space Administration, Washington, D.C.
LASERS AND CONTROLLED THERMONUCLEAR FUSION [LAZERY I UPRAVLYEMAYA THERMOYADERNAYA REAKTSIYA]
N. G. Basov et al Sep. 1971 14 p refs Transl. into ENGLISH from Priroda (Moscow), no. 1, Jan. 1971 p 7-15
(NASA-TT-F-13700) Avail: NTIS CSCL 20E

An analysis is presented of the processes occurring and the computations involved in thermonuclear reactions, pulsed thermonuclear reactions, and the interaction of a laser pulse with a substance. In addition, some experiments with a short pulse duration laser apparatus are described, and a discussion is given on the efficiency and possible prospects of laser utilization for thermonuclear fusion.
D.L.G.

N71-34443# National Weather Service, Silver Spring, Md. Space Operations Support Div.
PROBABILITY OF A CLEAR LINE-OF-SIGHT THROUGH THE ATMOSPHERE FOR A SATELLITE-BASED LASER COMMUNICATIONS SYSTEM: A FEASIBILITY STUDY
Richard A. Brintzenhofe, James L. Cox, James T. Williams, and Charles J. Neumann Mar. 1971 30 p refs
(NOAA-TM-NMS-SOS-7) Avail: NTIS

The effect of clouds on laser transmissions from space is investigated. Expressions are given in terms of cumulative frequencies for various percentages of clear line-of-sight conditions. Results from the simulated operations indicate that, with the capability of choosing one from usually three or more ground stations for each satellite passage, clear line-of-sight probabilities are sufficiently high to support the concept of laser communications between space and earth.
E.M.C.

N71-34444# American Optical Co., Southbridge, Mass. Central Research Lab.
NEODYMIUM LASER GLASS IMPROVEMENT PROGRAM Technical Summary Report, 1 Jan. - 30 Jun. 1967
Richard F. Woodcock Mar. 1971 41 p refs
(Contract Nonr-3835(00); ARPA Order 306)
(AD-724302; TR-568-10; TSR-10) Avail: NTIS CSCL 20/5

The report details efforts expended toward achieving a means for measuring the stress optical coefficients of both homogeneous and inhomogeneous laser glass test specimens. The design of a 3-pinhole interferometer is discussed and tests made are presented. Elastic properties are briefly treated as is information on glass sample preparation. Finally, a theoretical analysis of the three pinhole interferometer is appended.
Author (GRA)

N71-34445# Edgerton, Germeshausen and Grier, Inc., Santa Barbara, Calif.
ORGANIC DYE LASER HIGH POWER OPTICAL CARRIER Final Report
J. C. Clark Nov. 1970 9 p refs Excerpt from AEC R and D final report no. EGG-1183-2244, S-498-r, published August 1970
(Contract AT(29-1)-1183)
(EGG-1183-2262) Avail: NTIS

The organic dye laser technology has been investigated for its suitability as a high-power optical carrier for nuclear data telemetry. The laser characteristic desired is a smooth single pulse to 10 to 50 microsec duration with a peak power of several kilowatts. Tests of various organic dye solutions performed with both linear and helical flash lamp pump configurations have demonstrated the capability of the dye laser to provide the desired performance as well as serve as a useful tool in nuclear diagnostic applications such as data transmission during nuclear test events. Author (NSA)

N71-34446*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
VIBRATIONAL ENERGY TRANSFER IN EXPANDING MIXTURES OF N2 AND CO2 AS MEASURED BY AN ELECTRON BEAM
Daniel I. Sebacher, Robert W. Guy, and Louise P. Lee Washington Sep. 1971 19 p refs
(NASA-TN-D-6445; L-7076) Avail: NTIS CSCL 20E

The transfer of molecular vibrational energy was studied by means of the electron beam technique in expanding mixtures of N2 and CO2 heated by an electric arc. High-temperature flowing N2 was mixed in a plenum chamber with CO2 at total pressures of 5 to 10 atm (507 to 1013 kN/sq m) and total temperatures of 1500 to 4000 K and then expanded supersonically in a conical nozzle to free-stream conditions of about 0.05 mm Hg (7N/Sq m) and 150 K. Vibrational temperatures of N2 were measured in the expanded flow and compared with temperatures predicted by using a time-dependent technique for the numerical solution of the nonequilibrium flow. By means of this technique and the experimental data, the vibrational relaxation rates of expanding N2 and CO2 were deduced. The results indicate generally faster rates than those measured in shock tubes for the vibrational translational exchange in N2 and for the vibrational-vibrational exchange between the asymmetric stretching mode and the bending mode of CO2. Author

N71-34447# Grumman Aerospace Corp., Bethpage, N.Y. System Sciences Section.
STABILIZATION TECHNIQUES FOR HOLOGRAPHIC RECORDING SYSTEMS
Benjamin J. Pernick Aug. 1971 68 p refs
(RM-516) Avail: NTIS

Methods for obtaining stable holographic optical systems are discussed. Its intent is twofold: (1) to improve holographic recording quality and (2) to relax stringent stability requirements so that holography can be used outside a controlled laboratory environment. A passive stabilization method has been investigated. Intermittent exposure control is used to stop the motion of the fringe field to be recorded. This system can be effectively coupled with other known techniques to upgrade performance, or employed as the sole stabilization method. Passive control would be appropriate for hologram formation over long distances. Experimental results demonstrate the effectiveness of intermittent exposure control in the presence of strong disturbances. Author

N71-34448# United Kingdom Atomic Energy Authority, Culham (England).
LASERS AND THE REACTOR IGNITION PROBLEM
I. J. Spaulding Nov. 1970 11 p refs Presented at Intern. Conf. on Laser Produced Plasmas, Moscow, 11-27 Nov. 1970
(CLM-R-109; Conf-701122-2) Avail: AEC Depository Libraries; HMSO 14 p; BIS $0.60

Assuming a thermal efficiency of 1/3 and a laser heating efficiency (target energy/laser pumping energy) of 100%, most of these estimates of laser energy range between 10 and 1000 MJ, depending on the various assumptions which are made about the degree of solid-state target compression, the possibility of target tamping, and the required reactor power gain. Any energy gain due to fusion reactions in material other than the target is omitted in these calculations. These estimates of laser energy are then compared with the maximum fusion outputs that can be handled with and without damage to the structure, and the low permissible cost of replacing damaged components is stressed. The possibility of using nonlinear absorption of repetitively pulsed CO2 lasers to start up a steady-state stellarator reactor which is fueled by D-T pellet injection and has an output of approximately 10 GW(E) is then discussed. It is shown that laser energies as low as 80 kJ may be feasible and possible advantages and difficulties of such a hybrid inertial/magnetic confinement approach are outlined. Author (NSA)

N71-34449 Cornell Univ., Ithaca, N.Y.
THE INFLUENCE OF COLLISIONS ON RADIATIVE SATURATION AND LAMB DIP FORMATION IN CO2 MOLECULAR LASERS
Tehmau Kan (Ph.D. Thesis) 1970 99 p
Avail: Univ. Microfilms Order No. 70-17085

An experimental and theoretical study of collision effects in the radiative saturation behavior of molecular rotation-vibration transitions was made. The experimental technique involves the use of two monochromatic fields, a strong saturating field, and a weak probing field, to measure optically induced changes in the population distributions of a resonant transition. The differential inversion (defined as the unsaturated inversion minus the saturated inversion) on individual CO2 transitions at pressures below 1 torr were shown to exhibit a strong Doppler component in addition to the Lorentzian components expected of a Doppler broadened line. This mixed inhomogeneous-homogeneous behavior of the CO2 transitions evidenced in the additional Doppler component, represents the effects of velocity changing-collisions which act to prevent distortions in the equilibrium Gaussian line-shape and is prominent in CO2 due to the relatively long level lifetimes. Dissert. Abstr.

N71-34450 New Mexico State Univ., University Park.
RESONANCE SPECTROSCOPY WITH A SINGLE-MODE LASER
David Milam, (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms Order No. 70-16359

A laser which uses one ruby crystal as an oscillator, and a second ruby to produce a thermally tunable, narrow band-width, inter-cavity absorption loss has been designed and tested as a source for high-resolution spectroscopy. A frequency mismatch is produced between the R sub 1 emission doublet of the oscillator crystal and the corresponding R sub 1 absorption of the passive ruby by maintaining a 20 K relative temperature difference between the two crystals, both of which are held near liquid nitrogen temperature. The new laser has been used as a high-resolution source for measuring the R sub 1 absorption profile of .065% ruby. The absorption of the ruby sample is measured at a number of discrete positions as the frequency of the laser is tuned across the absorption transition of the sample. The resulting R sub 1 profile is in good agreement with published high-resolution measurements of the ruby absorption spectrum. Dissert. Abstr.

N71-34451 California Univ., Berkeley.
FAR-INFRARED GENERATION BY NONLINEAR OPTICAL INTERACTION
Dillard Wayne Faries (Ph.D. Thesis) 1969 88 p
Avail: Univ. Microfilms Order No. 70-13046

Two ruby lasers, simultaneously Q-switched by a single rotating prism, and operated at different temperatures are used as primary sources. The laser beams are combined and mixed in a nonlinear crystal, primarily lithium niobate. The nonlinear polarization at the frequency induced in the crystal acts as a source for generating far infrared. Tunability from 1.2 cm to 8.1 cm and from 21 cm to 37 cm is achieved by varying the lasing temperature and selective Q-switching of either transition. The output power is increased by phase-matching. Variation of power with deviation from phase-matching is measured. The far infrared radiation is analyzed with a Fabry-Perot interferometer, yielding values consistent with the difference of the two ruby laser

frequencies. Calculations for the power output including effects of laser mode-structure, absorption, birefringence, boundary conditions and phase-matching are presented. Dissert. Abstr.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-34452*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
THERMAL CONDUCTIVITY, ELECTRICAL RESISTIVITY, AND THERMOPOWER OF AEROSPACE ALLOYS FROM 4 TO 300 K. 3: ANNEALED INCONEL 718
J. G. Hust and L. L. Sparks 24 Nov. 1970 37 p refs
(NASA Order R-06-006-003)
(NASA-CR-121758; NBS-9775) Avail: NTIS CSCL 11F

Thermal conductivity, electrical resistivity, Lorentz ratio, and thermopower measurements are presented in tabular form. The apparatus used for the measurements is described and the method of data analysis is given. Author

N71-34453# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
TECHNIQUES DEVELOPED IN THE LABORATORIES OF THE METALLURGICAL RESEARCH DEPARTMENT
Apr. 1971 102 p In FRENCH
(CEA-N-1427(2)) Avail: AEC Depository Libraries

The techniques developed in the laboratories of the metallurgical research department are described. The purpose behind the techniques developed and the means available in the laboratories are indicated. The subjects discussed concern mechanical tests (tensile testing, hardness measurements, shattering, creep, and fatigue), fractography, X-ray crystallography, micrography, fabrication, transformation of metals, studies of irradiated metals, electron microscopy, and weldability. Author (NSA)

N71-34454# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
TECHNIQUES DEVELOPED IN THE LABORATORIES OF THE METALLURGICAL RESEARCH DEPARTMENT, VOLUME 1 [TECHNIQUES DEVELOPPEES DANS LES LABORATOIRES DU DEPARTEMENT D'ETUDES METALLURGIQUES]
Mar. 1971 92 p refs In FRENCH
(CEA-N-1427(1)) Avail: AEC Depository Libraries

The techniques developed in the laboratories of the metallurgical research department are described. The purpose of the techniques developed and the means available in the laboratories are indicated. Information is included on diffusion with or without external pressure, superficial diffusion, preparation of diffusion couple samples for analysis, counting measurements, compatibility of materials, microanalysis, electromigration, single crystals, the development of high hydrostatic pressure tests, the determination of thermodynamic characteristics, the kinetics of the phase transformations, and the construction of special equipment. Author (NSA)

N71-34455*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
DEPOSITION OF ALLOY FILMS Patent Application
Talivaldis Spalvins, inventor (to NASA) Filed 21 Apr. 1971 8 p
(NASA-Case-LEW-11262-1; US-Patent-Appl-SN-136008) Avail: NTIS CSCL 11P

A method of applying a metal alloy film or coating to an irregular shaped metal object is described. The technique combines evaporation and ion plating techniques to plate the metal object with an alloy coating in which the percent weight of each elemental metal is substantially the same as in the alloy powder. Official Gazette of the U.S. Patent Office

N71-34456*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DEPOSITION APPARATUS Patent Application
Joseph H. Judd, inventor (to NASA) and Raymond L. Clark, inventor (to NASA) Filed 28 Apr. 1971 9 p
(NASA-Case-LAR-10541-1; US-Patent-Appl-SN-138229) Avail: NTIS CSCL 11F

An apparatus for depositing a thin metallic film on nonmetallic materials is described. A very fine ionized vapor of the coating material is generated by striking an anode of the coating material against a heated anode. Specimens of the material to be coated are placed on both positive and negative plates which attract ions of the vapor and coat the specimen. Author

N71-34457*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NONDESTRUCTIVE SPOT TEST METHODS FOR TITANIUM AND TITANIUM ALLOYS Patent Application
Maywood L. Wilson, inventor (to NASA) Filed 21 Apr. 1971 13 p
(NASA-Case-LAR-10539-1; US-Patent-Appl-SN-136086) Avail: NTIS CSCL 11F

A method for spot test identification of titanium and various titanium alloys commonly used in aerospace applications is described. The spot test identification involves color codes obtained when a spot of concentrated hydrofluoric acid and a drop of concentrated nitirc acid are placed on the surface of the material to be tested. NASA

N71-34458# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
INVESTIGATION OF THE RESISTANCE BEHAVIOUR OF SUPERCONDUCTING ALLOY OF Nb PLUS 30 PERCENT Zr IN THE REGION OF H SUB c2
I. S. Khukhareva and I. N. Goncharov 1971 16 p refs In RUSSIAN
(JINR-P8-5733) Avail: AEC Depository Libaries

From the resistance transitions recrystallized samples in the form of a flat plate values were determined for the temperature range from 4.2 K to T sub c = 8.1 K. The measurement results are compared with the theory. Author (NSA)

N71-34459# Commissariat a l'Energie Atomique, Bruyeres-Le-Chatel (France). Centre d'Etudes.
STUDY OF IMPURITIES DISTRIBUTION IN A METAL (PLUTONIUM): REALIZATION AND STUDY OF REFERENCE SAMPLES TO BE USED IN ANALYTICAL CHEMISTRY
Jean-Pierre Billon, Michel Bufferesu, Suzanne Deniaud, Claude Genty, Claude Le Claincheet al Jan. 1971 59 p refs In FRENCH
(CEA-R-4071) Avail: AEC Depository Libraries

The distribution of impurities in a natural metal (plutonium) that has been remelted under vacuum was studied. Elements present at significant levels were found to be fairly homogeneously distributed. However, these metals could not be used as reference standards. A technique was used in which metallic powders were added to the metal. After melting and homogenization treatment, the metal was cut according to a convenient method for a statistical study and analyzed. Analysis of the plutonium for added elements was performed by mass spectrometry, spectrography, and spectrophotometry. The feasibility of preparing reference standards by this method is discussed. NSA

N71-34460# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
RECENT DEVELOPMENTS IN THE ELECTRODEPOSITION OF METALS IN FUSED SALT MEDIA
Raymond Darras Jan. 1971 20 p refs In FRENCH
(CEA-N-1376) Avail: AEC Depository Libraries

Methods are described to deposit most refractory metals in coherent and compact form, so that they can be used immediately. One method is based upon the electrolysis of pure alkaline fluoride mixtures, containing a convenient salt of the metal to be deposited. The operation is carried out in an inert atmosphere, at relatively low temperatures, taking advantage of the corresponding eutectics. An alternative method, developed separately, involves diffusion of the deposited metal onto the cathode from the anode. Alloy coatings made in this manner give to the base metals new possibilities especially with regards to fretting, mechanical properties, and high temperature oxidation resistance. Electrolysis of alkaline thiocyanates allows the sulfidation of steel at low temperatures, and has important advantages over classical methods. The three general electrolytic methods described are compared. Author (NSA)

N71-34461# United Kingdom Atomic Energy Authority, Harwell (England).
LMM AUGER SPECTRA OF SOME TRANSITION METALS OF THE FIRST SERIES
J. P. Coad (Oxford Univ.) and J. C. Riviere Jan. 1971 19 p refs
(AERE-R-6719) Avail: AEC Depository Libraries

The LMM peaks in the Auger spectra for the first transition series are identified according to all the evidence currently available with special reference to Fe, Co, and Ni. The similarity of results obtained with different types of analyzers is demonstrated. Author

N71-34462# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
AMORPHISATION OF Pd-Si ALLOY BY IRRADIATION WITH FISSION PRODUCTS
Daniel Lesueur [1971] 8 p refs Presented at the Intern. Conf. on Metastable Alloys, Brela, Yugoslavia, 28-30 Sep. 1970
(CEA-CONF-1693; Conf-700952-1) Avail: AEC Depository Libraries

A Pd-Si alloy (20 at. % Si) obtained in the amorphous state by cooling after melting was studied. The amorphous samples were annealed under vacuum at 600 C for 40 hours. X-ray diffraction diagrams showed the existence of two phases: a face centred cubic solid solution of Si and Pd and an orthorhombic phase Pd3Si. The samples were irradiated with fast neutrons or fission fragments U-235. The X-ray diffraction lines of the crystal phases disappeared continuously whereas broad rings characteristic of an amorphous structure appeared. No change in structure was observed after irradiation of an amorphous sample. The resistivity ratio of the tempered amorphous state to the crystalline state was found to be 9 at 20 K. Maxima were observed on the resistivity curves of several samples. The sample thickness is an important factor in the profile of the resistivity curves. NSA

N71-34463# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
INFLUENCE OF INITIAL CONTENT OF THE COOLING RATE FROM THE BETA PHASE TO PREFERRED URANIUM ORIENTATION FOLLOWING HEAT TREATMENT [VLIV VYCHOZIHO STAVU A RYCHLOSTI OCHLAZOVANI Z BETA FAZE NA PREDNOSTNI ORIENTACI URANU PO TEPELNEM ZPRACOVANI]
F. Volf, F. Slancar, and V. Kaaus Jan. 1970 28 p refs In CZECH; ENGLISH summary
(UJV-2525-M) Avail: AEC Depository Libraries

The effect of initial structures and textures and the influence of cooling rate from the beta region on the preferred orientation after heat treatment was investigated for commercial purity grade uranium. Various initial conditions were represented by two groups of fine grained material, coarse grained material and by a material which was swaged at lower temperatures after extrusion. More pronounced preferred orientations with negative growth indices in the direction of heat removal were formed during water quenching and after slow cooling. 10 C/sec. Intermediate cooling rates, 50 to 3000 C/sec, induced very weak textures, the characteristics of which approach the isotropic condition. Some partial differences were observed in the behavior of the swaged material. However, different initial structures and textures of the extruded uranium did not show any distinct influence on the degree and character of preferred orientation after heat treatment. Author (NSA)

N71-34464# Ohio State Univ. Research Foundation, Columbus. Dept. of Metallurgical Engineering.
EVALUATION OF THE GERARD-PAPIRNO CHARACTERIZATION OF NOTCH DUCTILITY IN HIGH-STRENGTH AISI 4340 STEEL, PHASE 1 Final Report
Donato Firrao and Joseph W. Spretnak 28 Feb. 1971 79 p refs
(Contract AT(11-1)-2048)
(COO-2048-2) Avail: NTIS

The Gerard-Papirno characterization of notch ductility is evaluated over a range of strength levels in AISI 4340 steel. The parameter, termed the ductility ratio, is compared to the notch root strain at onset of fracture determined by Griffis and Spretnak. The two parameters characterize the strength transition in toughness in a very similar manner. Theoretical justification of the Gerard-Papirno relationships is presented. The significance of the ligament ratio in the notched specimens is rationalized. The applicability of the ductility ratio characterization is demonstrated for those cases in which the net section stress exceeds the proportional limit. Author

N71-34465# California Univ., Berkeley. Lawrence Radiation Lab. Dept. of Materials Science and Engineering.
ELECTRON MICROSCOPY INVESTIGATIONS OF FERROUS MARTENSITES
Gareth Thomas Jan. 1971 41 p refs Presented at the American Inst. of Met. Eng., Las Vegas, Nev., 11 May 1970
(Contract W-7405-eng-48)
(UCRL-19648; Conf-700553-1) Avail: NTIS

Electron metallography of bcc or bct ferrous martensite in which particular attention is paid to the characterization of substructures is discussed. The transformation substructure is complex and new results are reported on multiple (112) twinning. The factors controlling the martensitic substructure are evaluated and it is concluded that the strength and deformation characteristics of martensite are the most important in determining whether the transformation deformation occurs by slip or twinning (or both). An appraisal is given of in situ transformations in the electron microscope particularly with regard to the nucleation problem and investigations of the interfacial structures. The potential role of high voltage electron microscopy is also discussed and some recommendations are offered for future investigations. Author

N71-34466# Tennessee Univ., Knoxville. Dept. of Chemical and Metallurgical Engineering.
APPLICATION OF ADIABATIC CALORIMETRY TO METAL SYSTEMS Progress Report, 1969 - 1970
E. E. Stansbury and C. R. Brooks 1970 49 p refs
(Contract AT(40-1)-3291)
(ORO-3291-14) Avail: NTIS

Measurements on the heat capacity of pure metals to their melting point, and an analysis of the data for assessing the contribution from anharmonic lattice vibrations are reported. Measurements on lead and zinc are completed, including data on the liquid state. These results, together with those on gold, are used to estimate the contributions from anharmonic lattice vibrations. Extensive measurements and analysis of the results were completed for pure nickel, pure iron, and Ni3Fe. The

capabilities of the digital computer are analyzed in terms of the calorimetric technique for the conversion of the data acquisition method and control techniques to programmed operation.
Author

N71-34467# Rensselaer Polytechnic Inst., Troy, N.Y.
PRECIPITATION AND DISPERSION HARDENING IN HCP ALLOYS Annual Report
Norman S. Stoloff 1 Mar. 1971 20 p refs
(Contract AT(30-1)-3719)
(RPI-3719-9) Avail: NTIS

Results of deformation studies on dilute Hf-base alloys are reported. Results showed that both oxygen in solution and hydrogen in the form of hydride particles embrittle hafnium. Oxygen promotes transgranular cleavage, while hydrogen produces both grain boundary embrittlement and cracks along hydride particles. It does not appear to be possible to retain significant quantities of hydrogen in solution in hafnium by rapid quenching. Strengthening by hydrogen reaches a plateau at about 2 at. % at 77 and 298 K. The severity of embrittlement by oxygen increases with decreasing temperatures. The effects of hydrogen on ductility at low temperatures, while not as severe, is significant, particularly at 4.2 K.
NSA

N71-34468# Addis Translations International, Woodside, Calif.
INTERACTION OF BERYLLIUM WIRE WITH AN ALUMINUM MATRIX [ETUDE DE L'INTERACTION ENTRE UN FIL DE BERYLLIUM ET UNE MATRICE ALUMINUM]
Jean-Pierre Trottier et al Apr. 1971 13 p refs Transl. into ENGLISH from the publ. 'AGARD International Symposium on Composite Materials, Paris, 2-3 April 1970' Paris, 1970 p 17-27
(SC-T-71-3021; Conf-700437-1) Avail: NTIS

Beryllium wire, both nickel-plated and with the nickel removed, is coated with aluminum by electrolysis. The diffusion phenomena are studied by X-ray diffraction, with a scanning electron microscope and by electron-microprobe analysis, after heat treatments of varying duration at 250, 480, and 600 C. Recrystallization of the wire and matrix is monitored by X-ray. At 250 C, and during short treatments at 480 C, the specimens' structure does not change significantly.
Author (NSA)

N71-34469# Northwestern Univ., Evanston, Ill.
ELECTRONIC BAND STRUCTURE AND PHYSICAL PROPERTIES OF THE ACTINIDE METALS AND THEIR COMPOUNDS
A. J. Freeman [1970] 13 p refs
(Contract AT(11-1)-2103)
(COO-2103-3) Avail: NTIS

The Symmetrized Relativistic Augmented Plane Wave method was used in energy band calculations for fcc and bcc Th, bcc U, fcc Pu, fcc Am, and fcc Cm. The results show that the actinides can be separated into two classes: (1) Th through U which can be considered as tight-binding band states, and (2) Pu and higher actinides, whose band overlaps are much reduced. Graphs of the band calculations are presented.
NSA

N71-34470*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENHANCED DIFFUSION WELDING OF TD-NiCr SHEET
Kenneth H. Holko and Thomas J. Moore Washington Sep. 1971 26 p refs
(NASA-TN-D-6493; E-6368) Avail: NTIS CSCL 11F

A method has been developed to successfully diffusion weld 0.060-in. thick TD-NiCr sheet. With this new method, parent metal strength was attained at 2000 F in tensile-shear and creep-rupture shear tests of lap welds. By light microscopy, the weld was indistinguishable from the parent material when specially processed (unrecrystallized) TD-NiCr was welded. The surfaces to be welded were prepared by sanding through 600-grit paper and electropolishing. A two-step weld cycle was used which consisted of initially hot pressing at 30 ksi and 1300 F for 1 hour, followed by hot pressing at 14 M 2 ksi and 2175 F for 2 hours.
Author

N71-34471*# National Aeronautics and Space Administration, Washington, D.C.
METALLURGY: A COMPILATION
1970 31 p
(NASA-SP-5940(01)) Avail: NTIS CSCL 11F

Metallurgical developments in testing and detection, properties of metals, and processing are briefly reported for possible technology utilization. These studies include titanium hydride detection, stress corrosion, heat cracking, nondestructive tests, magnetic properties, mechanical properties, thermal properties, corrosion protection, protective coatings, welding, extrustion, and plating.
N.E.N.

N71-34472# British Steel Corp., London (England). Metallurgy Dept.
STUDY OF FACTORS INFLUENCING SCATTER OF ELEVATED TEMPERATURE TENSILE TEST RESULTS
1970 39 p
(PB-197139; MG/QD/124/70) Avail: NTIS CSCL 11F

An investigation was made of the influence of variations in testing technique on scatter in results of room temperature and elevated temperature tensile tests, with the objective of identifying the major factors affecting testing error and then formulating improvements in technique through standardization which would lead to an effective reduction in this error.
Author (GRA)

N71-34473# Royal Inst. of Tech., Stockholm (Sweden). Div. of Working of Metals.
DYNAMIC DEFORMATION OF ALUMINUM AND COPPER AS A THERMALLY ACTIVATED PROCESS
Shyam Kinkar Samanta 1970 26 p refs
(PB-195611; APS-ME-49) Avail: NTIS CSCL 11F

The steady-state flow stress at high strain-rate and at elevated temperatures of commercial purity aluminium and copper was analysed using the theory of the thermally activated deformation of metals. The experimental activation energy for aluminium was determined to be 37.2 Kcal/mole and for copper to be 74 Kcal/mole. The experimental activation energy for aluminium is slightly higher than that observed both for creep and self-diffusion but for copper it is much higher than that observed both for creep and self-diffusion. Discussion for the observed discrepancy is given.
Author (GRA)

N71-34474# Dow Chemical Co., Golden, Colo.
EXPLOSIVE SHOCK HARDENING OF MAGNESIUM ALLOY
Anthony L. Rafalski 27 Apr. 1971 5 p refs
(Contract AT(29-1)-1106)
(RFP-1649) Avail: NTIS

Using the commercial LA-141A alloy (magnesium-14 weight percent lithium-1 weight percent aluminum), plate specimens were deformed by oblique explosive loading in an effort to obtain strengthening without a correspondent loss of ductility. Although ductility remained high, the maximum yield-strength increase produced was only about 20 percent. Additional experiments using flyer plates for higher pressures and a water quench to reduce annealing were found necessary to achieve optimum results.
Author

N71-34475# Cornell Univ., Ithaca, N.Y.
FORMATION AND MIGRATION OF ARTIFACT VACANCIES INDUCED ON GOLD SURFACES BY NEON FIELD ION MICROSCOPY
T. E. Schmid and R. W. Balluffi May 1971 18 p refs
(Contract AT(30-1)-3504)
(NYO-3504-53) Avail: NTIS

Quasi-stable field ion microscope (FIM) images of

well-annealed high purity gold specimens were obtained using pure neon as the imaging gas. The experimental technique employed internal image intensification (a channel plate multiplier) and allowed a large number of successive FIM images to be recorded photographically at a relatively high frequency during two runs. Significant concentrations of artifact surface vacancies were measured on all of the principal planes that were imaged. These concentrations were at least several orders of magnitude larger than any conceivable equilibrium bulk vacancy concentrations. The rapid recording technique allowed the formation of many of the artifact vacancies to be observed directly. Filmed sequences also proved that many of the surface vacancies underwent FIM-induced surface migration in the various planes. Possible mechanisms included; (1) effects due to the large electric field-induced stress acting on the surface; (2) bombardment of the surface by the polarized imaging gas atoms; and (3) possible electric field-induced chemical interaction between the imaging gas and the surface atoms. Author

N71-34476# Purdue Univ., Lafayette, Ind. School of Materials Science and Metallurgical Engineering.
DIFFUSION AND PRECIPITATION OF INERT GASES IN METALS Technical Progress Report, 1 Jun. 1970 -28 Feb. 1971
James R. Cost 28 Feb. 1971 6 p refs
(Contract AT(11-1)-1799)
(COO-1799-6) Avail: NTIS

Results of precipitation kinetics studies in Al-He systems by measurements of residual electric resistance, electron microscopy, and low temperature heat capacity are reported. In other work preliminary measurements of internal friction in He-Nb systems are reported. NSA

N71-34477# Dow Chemical Co., Golden, Colo.
CORROSION BEHAVIOR OF URANIUM-BASE U-Nb, U-Nb-Zr, AND U-Mo ALLOYS IN HYDROCHLORIC ACID AND OCEAN WATER
James M. Macki and Robert L. Kochen 26 Feb. 1971 12 p refs
(Contract AT(29-1)-1106)
(RFP-1586) Avail: NTIS

The corrosion rates and products for depleted uranium (Tub-alloy), U-4.5 wt % Nb, U-6 wt % Nb, U-8 wt % Nb, U-7.5 wt % Nb-2.5 wt % Zr (Mulberry), and U-10 wt % Mo were measured in ASTM ocean water at 26 C, 1N hydrochloric acid (HCl) at 26 C, and 0.1N HCl at 70 C. The six alloys tested, listed in order of increasing corrosion resistance to ocean water, are: Tuballoy, U-4.5 Nb, U-6 Nb, U-8 Nb, Mulberry, and U-10 Mo. In 1N HCl at 26 C the alloys, in order of increasing corrosion resistance, are: Tuballoy, U-4.5 Nb, U-6 Nb, U-10 Mo, Mulberry, and U-8 Nb. In 0.1N HCl at 70 C the positions of U-8 Nb and Mulberry are reversed from those given for 1 N HCl.
Author (NSA)

N71-34478# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
ISOTHERMAL TRANSFORMATIONS OF URANIUM-13 ATOMIC PERCENT NIOBIUM
Ross J. Jackson 9 Apr. 1971 7 p refs
(Contract AT(29-1)-1106)
(RFP-1609) Avail: NTIS

The isothermal-transformation behavior of the gamma phase of the uranium-13 at. % niobium alloy was determined for the temperature range between 23 and 640 C. Optical and electron metallography, hardness, and X-ray diffraction techniques were used to construct a time-temperature-transformation diagram. The diagram discloses two overlapping C-curves. The upper C-curve corresponds to a lamellar precipitation of alpha plus a niobium-deficient gamma-phase which gradually enriches in niobium to form the equilibrium gamma 2 structure. The lower C-curve is a general precipitation of alpha phase on dislocation.
Author (NSA)

N71-34479# Oak Ridge National Lab., Tenn.
EFFECT OF OXYGEN, HEAT TREATMENT, AND TEST TEMPERATURE ON THE COMPATIBILITY OF SEVERAL ADVANCED REFRACTORY ALLOYS WITH LITHIUM
C. E. Sessions and J. H. De Van Apr. 1971 48 p refs
(Contract W-7405-eng-26)
(ORNL-4430) Avail: NTIS

The niobium alloys D-43, B-66, FS-85, Cb-752, and Cb-753 and the tantalum alloy T-111 were tested in static lithium at 500 and 1000 C. The compatibility of the alloys with lithium was examined from the standpoint of the oxygen content and prior heat treatment of each alloy. Specimens of the alloys were internally oxidized at 1000 C under partial pressure of 0.00009 torr O2 to produce concentrations of 100 to 3000 ppM O. Some of these specimens were then heat treated in vacuum at 1000, 1300, and 1600 C. Oxygen-contaminated specimens exposed to lithium without prior heat treatment exhibited Widmanstatten precipitates at 500 C for high oxygen concentrations and heavy intergranular attack at 1000 C for all levels of oxygen contamination. The susceptibility to attack of these oxidized alloys that had not been heat treated was eliminated by a heat treatment at 1300 to 1600 C before exposure to lithium. The resistance to corrosion afforded by heat treating the contaminated alloys is attributed to homogenization and subsequent precipitation of the oxygen present as either hafnium or zirconium oxide. Author (NSA)

N71-34480# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
STAINLESS STEEL CLADDING DEVELOPMENT Quarterly Progress Report, period ending 31 Dec. 1970
William E. Ray Feb. 1971 42 p refs
(Contract AT(30-1)-4210)
(WARD-4210-T-3-2) Avail: NTIS

Post-test stainless steel specimen characterizations using strain profile measurements, local wall thickness reductions, rupture morphology, and metallography were continued. Long term 1300 F, air atmosphere, stress rupture tests of both plug drawn and planetary swaged Type 316 stainless steel tubing have shown that for hoop stresses below about 12,000 psi, annealed tubing has both longer stress rupture life and greater rupture ductility than 20% cold worked tubing. Correlation of rupture morphology with twelve combinations of material variables and with stress rupture conditions has shown that rupture morphology is influenced strongly by the level of cold work, the grain size, and to lesser extent by the fabrication method and melting practice. For a given material there appears to be a stress level below which only pinhole rupture is observed and above which mixed-type ruptures occur. Author (NSA)

N71-34481*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY INVESTIGATION OF EFFECTS OF EXPOSURE TO SULFUR HEXAFLUORIDE ON TENSILE AND YIELD STRENGTHS OF ALUMINUM AND STEEL
Cecil E. Kirby and Philip O. Ransone Washington Sep. 1971 16 p refs
(NASA-TM-X-2333; L-7587) Avail: NTIS CSCL 11F

Results are presented from an experimental investigation to determine the effects of sulfur hexafluoride (SF6) on the tensile strength and yield strength of various metals. At present, data concerning the effects on metals exposed to SF6 are available for temperatures up to approximately 375 K and pressures up to 1 atmosphere. Additional data at higher temperatures and pressures are necessary because of the recently suggested use of sulfur hexafluoride as a test gas for the simulation of exhaust gas products from solid-propellant rocket motors. Specimens of 2024-T6 and 6061-T6 aluminum alloys, cold-rolled AISI C-1020 steel, and annealed AISI type 304 and 316 stainless steels and AISI No. 4130 steel were exposed to SF6 at a temperature of 500 K and a pressure of 3.62 MN/sq m for 8, 16, and 24 hours. Results indicate that SF6 does not degrade the tensile strengths of any of the metals tested for up to 24 hours exposure at 500 K and 3/62 MN/sq m. A discussion of the

physical and chemical characteristics of sulfur hexafluoride which make it attractive as a test gas for solid-propellant rocket-motor exhaust-gas simulation is also included. Author

N71-34482# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
COLLABORATIVE PROGRAMME ON THE CREEP FATIGUE BEHAVIOUR OF 1 PERCENT Cr-Mo-V
B. J. L. Darlaston Jan. 1971 15 p
(RD/B/N-1889) Avail: AEC Depository Libraries

An informal collaborative program was set up to examine the creep fatigue behavior of 1Cr-Mo-V-steel. The program of work covers uniaxial, biaxial, and multiaxial cyclic behavior of the material. The common objective is to provide a method which can be used to predict satisfactorily the integrity of power plant components under thermal fatigue conditions. Author (NSA)

N71-34483# British Steel Corp., London (England). Metallurgy Dept.
THE INTERNATIONAL COMMISSION FOR THE STUDY AND RATIONALISATION OF METHODS FOR THE DETERMINATION OF GASES IN STEEL: REPORT OF 14TH PLENARY MEETINGS
P. H. Scholes 1971 5 p refs Conf. held Apr. 1970
Supersedes MG/D/633/70
(PB-199294; MG/D/412/71) Avail: NTIS CSCL 11F

A collaborative program for the determination of oxygen, nitrogen, and hydrogen in steel is reviewed. GRA

N71-34484 National Lending Library for Science and Technology, Boston Spa (England).
MECHANISMS OF AGING AND HARDENING STRUCTURES IN HEAT TREATED ALUMINIUM ALLOYS
M. Conserva et al 13 Apr. 1971 35 p refs Transl. into ENGLISH from Alluminio (Milan), v. 10, Oct. 1970 p 515-532
(NLL-M-20410-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 5 NLL photocopy coupons

The theories of precipitation, reprecipitation, and hardening mechanisms in heat treated aluminium alloys are reviewed. Several heat treatable aluminum alloy systems are described including AlCu, AlCuMg, AlCuMgSi, AlMgSi, and AlZnMg(Cu). The effects of structural parameters on the metallurgical properties of the alloys are discussed including vacancies, crystal dislocations, grain boundaries, insoluble particles, and alloying element. Quench rate, storage period between quenching and artificial aging, and plastic deformation effects are also discussed. J.M.

N71-34485 National Lending Library for Science and Technology, Boston Spa (England).
THE WETTABILITY OF POWDERED FERROCHROME AND CHROMIUM OXIDE BY CAST IRON
E. S. Ten et al 2 May 1971 8 p refs Transl. into ENGLISH from Izv. Vyssh. Uchab. Zaved. (USSR), v. 1, 1971 p 149-152
(NLL-M-21010-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The falling drop method is used to determine the wettability of ferrochrome and pure and commercial chromium oxides by low-silicon cast iron. The results of the investigation show that the oxide films, both on the fresh cast iron surface and on the grain surfaces of the powder substrate impair wettability, while the presence of carbon in the substrate and chromium in the melt improves wettability. Analysis of the experimental results indicates possible mechanisms explaining these phenomena and methods are suggested, on the bases of these, for improving the wettability of the powders from the point of view of obtaining an alloyed surface layer on castings. Author

N71-34486 National Lending Library for Science and Technology, Boston Spa (England).
INFLUENCE OF RATE (OF DEFORMATION) ON THE RESISTANCE TO HOT PLASTIC DEFORMATION OF SOME NICKEL-BASE ALLOYS
Ya. S. Shvartshart 12 May 1971 10 p refs Transl. into ENGLISH from the Russian
(NLL-M-21012-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The influence of deformation rate on the yield stress of five nickel base alloys was studied by comparing the yield stresses in stretching standard test pieces. Results show that the yield stress of the alloys depends significantly on the rate of deformation. The value of the degree of increase in resistance to deformation (rate parameter) was shown to increase considerably with rising temperature. Author

N71-34487 National Lending Library for Science and Technology, Boston Spa (England).
EXAMINATION OF THE EFFECT OF VACANCY CONCENTRATION ON THE AGE HARDENING KINETICS OF AlZnMg ALLOYS
J. Schubert 12 Mar. 1971 22 p refs Transl. into ENGLISH from Neue Huette (East Germany), v. 12, no. 8, Aug. 1967 p 494-500
(NLL-M-20407-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Mathematical calculations of vacancy concentrations were compared with the age-hardening behavior of AlZnMg alloys, to decide whether the clustering rate is determined by the concentration of the Mg atom-vacancy pairs. The mathematical model is qualitatively confirmed, despite deviations from the forecast behavior of some selected experimental variables which were probably subject to an unknown interaction between vacancies and the highly dispersed initial forms of the single phase clustering. Based on the particular characteristics of the AlZnMg system, it was concluded that technically desirable acceleration of clustering by means of alloying effects is not possible. Author

N71-34488 National Lending Library for Science and Technology, Boston Spa (England).
ON THE CORRELATION BETWEEN THE DEFORMATION SUBSTRUCTURE, PRECIPITATES, RECRYSTALLIZATION STATE AND STRESS CORROSION BEHAVIOUR OF A TERNARY AlZnMg ALLOY
A. Gierda et al 2 Mar. 1971 27 p refs Transl. into ENGLISH from Alluminio (Italy), v. 38, no 9, Sep. 1969 p 447-456
(NLL-M-20372-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The deformation substructure of an aluminum, zinc, magnesium alloy heat treated to various states of susceptibility to stress corrosion was investigated by electron microscopy. The substructure is affected not only by the type of hardening precipitate but also by the recrystallization state of the material and by the precipitates with an anti-recrystallization effect. The results of the investigation are applied to better understanding of stress corrosion cracking. Author

N71-34489 National Lending Library for Science and Technology, Boston Spa (England).
THE MECHANISM OF THE MELTING OF METALS
Yu. S. Nechaev et al 2 May 1971 7 p refs Transl. into ENGLISH from Izv. Vyssh. Uchab. Zaved. (USSR), v. 1, 1971 p 131-134
(NLL-M-21008-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The electrical resistances of aluminium and copper were measured while they were being heated at 100 to 10,000 c/s from different initial temperatures until the specimens melted and fractured. The data obtained compared well with the vacancy model of melting. Author

N71-34490 West Virginia Univ., Morgantown.
THE MAGNETOSTRICTIVE BEHAVIOR OF SINGLE CRYSTAL NICKEL AND COPPER NICKEL ALLOYS

Gary Niles Benninger (Ph.D. Thesis) 1969 99 p
Avail: Univ. Microfilms Order No. 70-15249

Saturation magnetostriction was measured as a function of temperature, magnetic field, composition, and direction of magnetization using standard strain gage techniques. The data was fitted to a five-constant magnetostriction equation using a least-squares computer program. The absolute values of the constants decrease monotonically to zero from 77 K to the Curie point, with the exception of A1 which exhibits a composition dependent maximum. The constants for Ni have been found to be in fair agreement with the Callen-Callen theory of magnetostriction. The inclusion of the exchange energy as part of the total energy of the crystal leads to a forced volume magnetostriction which is separable into isotropic and anisotropic parts, the former depending on the exchange energy and the latter the anisotropy energy. The various volume effects were determined experimentally for Ni as a function of temperature. Dissert. Abstr.

N71-34491 Maryland Univ., College Park.
MANY-BODY EFFECTS ON THE SOFT X-RAY EMISSION SPECTRA OF METALS
George Addison Ausman, Jr. (Ph.D. Thesis) 1969 202 p
Avail: Univ. Microfilms Order No. 70-15388

The role of many body effects in the soft X-ray emission of metals was investigated. Many body diagrammatic techniques have been applied to the calculation of the K emission spectrum of lithium for energies both above and below the Sommerfeld threshold. The four first-order electron-electron interaction processes give rise to a tail to the main emission band and a plasmon satellite band. This band arises from the long-range coherent interaction of the electrons which results in plasmon excitation, and is a reflection of the main band shifted to lower energies by the amount of the plasmon excitation energy. The first-order perturbation treatment of soft X-ray emission diverges for all energies above the Sommerfeld threshold. Corrections to the radiation vertex arising from the interaction of the conduction electrons with the deep state hole, that exists prior to X-ray emission, lead to large contributions to the emission intensity in the main band and a divergence at the high energy threshold. Dissert. Abstr.

N71-34492 National Lending Library for Science and Technology, Boston Spa (England).
INTERACTIONS OF GROUP VIA METALS WITH HAFNIUM, RUTHENIUM AND OSMIUM
A. K. Shurin 17 Mar. 1971 6 p refs Transl. into ENGLISH from Diagrammy Sostoyaniya Metal. Sistem, Mater. Vses Soveshch., 1968 p 78-81 In ENGLISH and RUSSIAN
(NLL-LTI-746-688-(9022.401); LTI-737-5741) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Phase diagrams for hafnium-chromium, hafnium-molybdenum, and tungsten-hafnium are presented. The physical, mechanical, and thermodynamic properties of the alloys are discussed. Crystal lattice structures of the various alloys at different temperatures are described. Author

N71-34493 National Lending Library for Science and Technology, Boston Spa (England).
LOW-ALLOY 12 PERCENT CHROMIUM STEEL WITH NITROGEN
G. P. Alekseeva and B. N. Meshchaninov 17 Mar. 1971 6 p Transl. into ENGLISH from Metallov. term Obrab. Metallov., no. 8, 1970 p 12-14
(NLL-LTI-746-748-(9022.401)) Avail: Natl. Lending Library, Boston Spa Engl.: 1 photocopy coupon

A 12% chromium steel with nitrogen (without nickel) was devised for work at 600 to 650 C. It is necessary to replace the nitrogen by 0.9 to 1.0% nickel to apply this steel in the cast state. During the determination of the mechanical properties of the test steels in a cast state, it was established that, with satisfactory (in time) rupture resistance, proof stress, elongation and reduction of area, the steel possesses a low impact strength less than 1 kgm/sq cm. In this connection, the necessity of changing the chemical composition of the cast steel was determined. E.M.C.

N71-34494 Wisconsin Univ., Madison.
ATOMIC HYDROGEN REACTIONS ON CLEAN METAL SURFACES
Steven Paul Fossum (Ph.D. Thesis) 1970 130 p
Avail: Univ. Microfilms Order No. 70-12728

A series of experiments are described in which hydrogen atoms react catalytically on metal surfaces. The reactions studied included hydrogen atom recombination, and production of methane from hydrogen atoms incident on carbon monoxide covered metals. Recombination was studied on metal surfaces after the surfaces were cleaned by heating and by exposure to hydrogen atoms, and in one case by heating in the presence of oxygen. Recombination on the samples of Au, Ag, Cu, Pt, Fe, Ni, W, Mo, and stainless steel yielded recombination coefficients of 1.0 below temperatures at which atomic hydrogen desorption was possible. The effects of contamination due to oxygen exposure are studied on Au, Fe, and Ni, while the effect of carbon monoxide exposure is observed on Ag, W and Mo. Recombination coefficients were independent of pressure in the range studied. Methane production was searched for on samples of Fe, Ni, Mo, and Ti after studying production on the walls and stainless foils. No proof of methane synthesis was observed on any sample. Dissert. Abstr.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-34495*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACECRAFT ADHESIVES FOR LONG LIFE AND EXTREME ENVIRONMENTS
W. D. Roper 1 Aug. 1971 20 p refs
(Contract NAS7-100)
(NASA-CR-121632; JPL-TR-21-1637) Avail: NTIS CSCL 11A

A review of the state-of-the-art of high performance adhesives was undertaken for the purpose of establishing those newer materials which show potential for future application in spacecraft. Following the state-of-the-art review, several adhesive materials were selected and evaluated in the laboratory. The adhesive materials evaluated included the polyimide, the polybenzimidazole, and the polyquinoxaline polymer systems. In the laboratory work the thermal shock resistance of each material was determined by thermal cycling through the temperature range of 204 to -73 C. In addition, each adhesive was evaluated for long term elevated temperature performance in aging tests conducted at 260 C and 10,000 N/sq cm for 5000 h. The results of this investigation showed that the polyimide adhesive system currently has the greatest potential for use in future spacecraft applications. Author

N71-34496*# Los Alamos Scientific Lab., N. Mex.
CMB-13 RESEARCH ON CARBON AND GRAPHITE
Summary of Progress, 1 Nov. 1970 - 31 Jan. 1971
Morton C. Smith Jul. 1971 41 p refs
(NASA Order W-12595)
(LA-4714-MS; Rept-16; NASA-CR-121711) Avail: NTIS CSCL 11D

Research and development on carbon and graphite were undertaken to increase understanding of their properties and behavior as engineering materials, to improve the raw materials and processes used in their manufacture, and to learn how to

produce them with consistent, predictable, useful combinations of properties. The approach taken is microstructural, based on study and characterization of natural, commercial, and experimental carbons and graphites by such techniques as X-ray diffraction, electron and optical microscopy, and porosimetry. Physical and mechanical properties are measured as functions of formulation, treatment, and environmental variables, and correlations are sought among properties and structures. Raw materials and manufacturing techniques are investigated, improved, and varied systematically in an effort to create specific internal structures believed to be responsible for desirable combinations of properties. Author

N71-34497*# Cincinnati Univ., Ohio.
THERMODYNAMIC PROPERTIES OF TERNARY REFRACTORY CARBIDES. 2: ZIRCONIUM-URANIUM-CARBON
Michael Hoch and M. G. Hapase Wright-Patterson AFB, Ohio. AFML Dec. 1969 27 p refs
(Grant NGR-36-004-014; Contract F33615-67-C-1565)
(NASA-CR-121678; AD-701737; AFML-TR-69-209-Pt-2) Avail: NTIS CSCL 11B

The thermodynamic properties of ternary zirconium-uranium carbide having the sodium-chloride type structure were studied using the time-of-flight mass spectrometer. The radio of the activities of the components was measured as a function of composition at 2440 K. From the variation of the ratio of activities with composition, the pairwise interaction energies were obtained. The metal-metal interaction energy is similar to that in the body-centered cubic zirconium-uranium metallic system. The difference between the zirconium-carbon and uranium-carbon interaction energy E sub 13 - E sub 23 is a function of composition and can be expressed as: E sub 13 - E sub 23 = 8.5 + or - 05- (23.6 + or - 0.2)x in kcal/mole. Author

N71-34498# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaire.
ADVANTAGES OF A TEFLON-CARBON MIXTURE IN THE CONSTRUCTION OF CAVITY IONIZATION CHAMBERS MEASURING THE ABSORBED DOSE IN AIR [INTERET D'UN MELANGE TEFLON-CARBONE POUR LA REALISATION DES CHAMBRES A CAVITE MEASURANT LA DOSE ABSORBEE DANS L'AIR]
Jean-Pierre Simoen, Leodamas Sklavenitis, Gilbert Troesch, and Lucien Pages Mar. 1971 23 p refs In FRENCH
(CEA-R-4173) Avail: AEC Depository Libraries

The theoretical calculation of the absorbed dose in the air from that measured in a cavity within a given material enables one to establish the necessary correction factor as well as the condition of equivalence of two materials from the dosimetric viewpoint. A comparative study of various materials currently used in the construction of ionization chambers, for example graphite, nylon, etc., with a Teflon-carbon mixture reveals that this mixture is an excellent air equivalent material and particularly suitable for cavity ionization chambers. Author (NSA)

N71-34499# Kernforschungsanlage, Juelich (West Germany).
IRRADIATION BEHAVIOR OF PLASTICS [BESTRAHLUNGSVERHALTEN VON KUNSTSTOFFEN]
G. Ekstroem Oct. 1970 346 p refs In GERMAN and ENGLISH
(JUL-Bibl-15) Avail: AEC Depository Libraries

The 9 abstracts were taken from Nuclear Science Abstracts (1963 - 69) and Chemical Abstracts (1966 - 68). The abstracts are arranged chronologically and according to chemical symbol and functional group: hydrocarbons, hydrocarbon derivatives, carbolic acid and its derivatives, amines, resins, silicones, and rubbers. The kinds of radiations considered are alpha, beta, gamma, x, neutrons, and ionizing radiations. Six indexes are included: (1) chemical names of plastics with trade names and physical properties, (2) kind of radiation, (3) trade name, (4) author, (5) patent, and (6) report. Author (NSA)

N71-34500*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SYNTHESIS OF SUPERCONDUCTING COMPOUNDS BY EXPLOSIVE COMPACTION OF POWDERS Patent Application
Upendra Roy, inventor (to NASA) (Alabama Univ.), Guenther Otto, inventor (to NASA) (NAS-NRC), and Orvil Y. Reece, inventor (to NASA) Filed 8 Jul. 1971 8 p
(Contract NSR-09-012-087)
(NASA-Case-MFS-20861; US-Patent-Appl-SN-160860) Avail: NTIS CSCL 11D

A method for synthesizing superconducting intermetallic compounds is discussed. The method of consists of preparing a finely divided mixture of metal powders, placing the mixture in a tubular metal casing with closed ends, surrounding the tube with an explosive charge, and detonating the explosive. The resulting shock wave produces the necessary reaction conditions for intermetallic compound formation. NASA

N71-34501*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif..
INTUMESCENT COMPOSITION, FOAMED PRODUCT PREPARED THEREWITH, AND PROCESS FOR MAKING SAME Patent Application
Salvatore R. Riccitiello, inventor (to NASA) and John A. Parker, inventor (to NASA) Filed 6 May 1971 10 p
(NASA-Case-ARC-10304-1; US-Patent-Appl-SN-140946) Avail: NTIS CSCL 11D

An intumescent composition and the foamed product prepared by heating it are described. The composition comprises the reaction product of para-benzoquinone dioxime and a concentrated mineral acid such as sulfuric acid, phosphoric acid, or polyphosphoric acid. The composition is useful as an intumescent agent either by itself or when combined with other materials. A fire-resistant and heat-insulating composition is obtained by heating the intumescent composition above its intumescent temperature. NASA

N71-34502*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
GRAPHITE-REINFORCED ALUMINUM COMPOSITE AND METHOD OF PREPARING THE SAME Patent Application
Felix P. Lalacona, inventor (to NASA) Filed 24 Mar. 1971 11 p
(NASA-Case-MFS-21077; US-Patent-Appl-SN-127481) Avail: NTIS CSCL 11D

Graphite-reinforced aluminum composite material is prepared by coating high strength, high modulus, and low density graphite fiber with nickel, aligning the coated fibers between and in contact with aluminum sheets in a stacked array, and bonding the array into an integral body by application of heat and pressure. The resulting diffusion-bonded composite shows favorable mechanical properties, the graphite fibers remaining intact during the preparation process. Damaging reactions at the graphite surface are prevented by the protective nickel coating. The graphite-reinforced material prepared by the above method can be subjected to shaping or forming operations without breaking the fibers. NASA

N71-34503# Wisconsin Univ., Madison. Dept. of Radiology.
CHARACTERISTICS OF SOME TLD SOLID SYSTEMS
F. M. Lin and J. R. Cameron [1971] 16 p refs
(Contract AT(11-1)-1105)
(COO-1105-120) Avail: NTIS

The performance of three commercial LiF thermoluminescent dosimeters is discussed. Lithium fluoride embedded in a Teflon matrix, LiF embedded in silicon rubber products, and extruded LiF were tested. NSA

N71-34504# Technische Hogeschool, Eindhoven (Netherlands).
RHEOLOGICAL PROPERTIES OF ALKALI BORATE GLASSES

Theodorus Johannes Maria Visser (Ph.D. Thesis) 31 Mar. 1971 88 p refs
Avail: NTIS

A study of the rheological behavior of borate glasses in the region of high viscosity is presented. Specifically, the influence of small amounts of water on the rheological properties of glass is investigated. The Pochettino type viscometer was chosen for carrying out the investigations and the apparatus and experimental procedures are described. An investigation of the occurrence, if any, of delayed elastic effects has yielded a loading procedure, which enables these effects to be separated from the viscous flow. The average of two shearing velocities measured for a previous lower and a previous higher load has proved to be a good approach of determining the stationary velocity at purely viscous flow. The rheological properties of the anhydrous alkali borate glasses (melted in vacuo) are described. The influence of water on the rheological properties has been investigated for boric oxide glass and two sodium borate glasses. Author

N71-34505# Air Force Systems Command, Wright- Patterson AFB, Ohio. Foreign Technology Div.
LUBRICATING COMPOSITION FOR MERCURY WATER SEALS
A. M. Kuliev et al 29 Dec. 1970 8 p Transl. into ENGLISH from Prisadki k Smazochnym Maslam (USSR), no. 2, 1969 p 128-130
(AD-721032; FTD-HT-23-763-70) Avail: NTIS CSCL 11/8

The maximum operating capabilities of mineral fluids used in mercury water seals are characterized by the average magnitude of critical velocity. The latter is determined by the potential physicochemical properties of the mineral crude. The authors prepared lubricating compositions based on a low-viscosity oil fraction by thickening it with the copolymer of isobutylene with styrene or with polyisobutylene in concentrations of 0.9 to 3.0 %. The proposed compositions were subjected to preliminary testing on a laboratory Mercury seal. Author (GRA)

N71-34506# Gulf General Atomic, San Diego, Calif.
RESEARCH ON GRAPHITE Quarterly Progress Report, period ending 14 Feb. 1971
G. B. Engle, R. J. Price, and J. C. Bokros 12 Mar. 1971 14 p refs
(Contract AT(04-3)-167)
(GA-10533) Avail: NTIS

Irradiations of nuclear graphites and model carbons were continued. Physical properties and structural characterizations for the unirradiated graphites are reported. The microstructure of a needle-coke type nuclear graphite was determined. It was shown to consist of a range of carbon structures with varying crystallite sizes and particle shapes. Author (NSA)

N71-34507# Hercules Powder Co., Cumberland, Md. Allegany Ballistics Lab.
DEVELOPMENT OF IMPROVED CELLULOSE ACETATE MEMBRANES
Mark E. Cohen, Michael A. Grable, and Billy M. Riggleman Sep. 1970 108 p refs
(Contract DI-14-30-2527)
(PB-198952; OSW-PR-608) Avail: NTIS; SOD $1.00 CSCL 07A

The objectives of the program were to develop improved hollow-fiber membranes for reverse osmosis and to evaluate the best membranes developed in a bench-scale module. Both asymmetric and composite membranes were investigated. These studies produced a high performance asymmetric hollow-fiber membrane which operated successfully in modules with capacities up to 175 gpd. Substantial progress was also made toward preparing high-flux composite membranes. Composite membranes were prepared by directly coating cellulose nitrate shock gels with dilute chloroform solutions of cellulose triacetate and mixtures of cellulose triacetate and high-molecular-weight polyethylene glycols. Author (GRA)

N71-34508# Oak Ridge National Lab., Tenn. Reactor Chemistry Div.
EFFECTS OF FAST NEUTRONS ON POLYCRYSTALLINE ALUMINA AND OTHER ELECTRICAL INSULATORS AT TEMPERATURES FROM 80 TO 1230 DEGREES C
G. W. Keilholtz, R. E. Moore, and H. E. Robertson May 1971 109 p refs
(Contract W-7405-eng-26)
(ORNL-4678) Avail: NTIS

The effects of fast neutrons on four commercial polycrystalline alumina products of high density were investigated. These materials were considered for use as electrical insulators in nuclear powered thermionic converters. Based on the irradiation results, the following conclusions and recommendations were made for the use of polycrystalline alumina in thermionic converters: (1) the alumina should be of high purity to minimize gross fracturing, and it should be of small grain size to minimize the effects due to separation at grain boundaries, (2) the thermionic device should be designed for continuous operation because thermal cycling apparently promotes separation at grain boundaries, (3) the design should allow for an increase in volume of the alumina insulators of about 3%, and (4) alumina of high purity and small grain size can withstand fast neutron fluences up to about 3 x 10 to the 21st power neutrons/sq cm in an ETR type neutron spectrum and up to about 2 x 10 to the 21st power neutrons/sq cm in an EBR-2 type spectrum for those neutrons with energies greater than 1 MeV. Author (NSA)

N71-34509# Sandia Corp., Albuquerque, N. Mex.
SOME THEORETICAL ASPECTS OF THE PROPAGATION OF STRESS WAVES THROUGH COMPOSITE MATERIALS
D. S. Drumheller Apr. 1971 58 p refs
(SC-RR-710024) Avail: NTIS

The effects of both transient and harmonic waves on composite materials are studied and compared by means of a dispersion analysis and a special linear-elastic wave propagation code. The influences of reinforcement geometry and nonlinear material behavior are discussed, and a correlation is made between the behavior of a wave filter and the dynamic behavior of composites. Author

N71-34510# Sandia Corp., Albuquerque, N. Mex.
DELAYED FAILURE IN GLASS
S. C. Keeton Apr. 1971 74 p refs
(Contract AT(29-1)-789)
(SCL-RR-710010) Avail: NTIS

The experimental studies on static fatigue in glass are reviewed. At lower stresses, fatigue occurs as a result of a thermally activated chemical reaction that forms silanol sites on the glass surface behind the propagating crack. At higher stresses, the reaction seems to be transport controlled and, as such, is not thermally activated. The rate of fatigue depends on both the type and size of the flaws and on the medium in contact with the glass. The initial fatigue in various glasses up to about 10 on the reduced time scale is described by a single curve. Thereafter, the curve for a particular glass approaches an asymptotic value known as the static fatigue limit. Author

N71-34511# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
PURIFICATION OF BORON COMPOUNDS BY PYROHYDROLYSIS
C. R. Schmitt and R. K. Edwards 28 May 1971 26 p refs
(Contract W-7405-eng-26)
(Y-1756) Avail: NTIS

Laboratory studies were made concerning the steam pyrohydrolysis treatment of impure elemental boron powders and potassium fluoborate powder, recovery and purification of boric acid by recrystallization from water and alcohol solutions, and the effects of various materials of construction on the purity of the recrystallized boric acid. Author

N71-34512 National Lending Library for Science and Technology, Boston Spa (England).
EVENT OF THE DAY: CREATION OF DIAMONDS
[1971] 4 p Transl. into ENGLISH from Sots. Industriya, 19 Mar. 1971
(NLL-M-20583-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The developmental history of the chemical synthesis of diamonds is briefly reviewed. Filiform diamond synthesis in the U.S.S.R. utilizing a reactor and seed diamonds is also covered.
J.M.

N71-34513 National Lending Library for Science and Technology, Boston Spa (England).
CORROSION PROTECTION OF METALS BY COATING WITH THERMOSETTING PLASTICS
G. Menges et al [1971] 26 p refs Transl. into ENGLISH from DFBO Mitt., v. 21, no. 4, 1970 p 66-71
(NLL-M-20609-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

Factors influencing the protective life of thermosetting plastic coatings and techniques for quality improvement and cost reduction are discussed. Blister formation in a corrosion protection film; aging effects on the development of pore, cavity, and crack defects; and pretreatment, pigment, diffusion, swelling, adhesion, and film thickness effects are included.
J.M.

N71-34514 Connecticut Univ., Storrs.
ENERGY BAND STRUCTURE OF ALUMINUM OXIDE
Frank Curtis Douglas (Ph.D. Thesis) 1970 183 p
Avail: Univ. Microfilms Order No. 70-15532

A band structure calculation for aluminum oxide has been performed using a mixed-basis set consisting of all occupied ion orbital functions plus plane waves. The aluminum 3(+) ions and the oxygen 2(-) ions are both taken as having the closed shell configuration 1s2 2s2 2p6. With ten ions per unit primitive rhombohedral cell, there are 50 ion functions in the basis set, to which were added 15 plane waves. The basis set was not orthogonalized; hence matrix elements of the Hamiltonian and of unity were required, and solution of the eigenvalue problem required simultaneous diagonalization of both the overlap and Hamiltonian matrices. For the calculation of matrix elements, the two-center approximation was used, and integrals were restricted to nearest neighbors of each ion type. The energy levels were calculated at the center, the Z surface point, and along the axes labeled lambda, delta, and sigma. A direct band gap was found to occur at the center of the zone with a calculated value of 7.6 eV.
Dissert. Abstr.

N71-34515 Cornell Univ., Ithaca, N.Y.
NUCLEAR MAGNETIC RESONANCE IN THE CESIUM-GRAPHITE INTERCALATION COMPOUNDS
Gary P. Carver (Ph.D. Thesis) 1970 127 p
Avail: Univ. Microfilms Order No. 70-17074

The C-13 and Cs-133 nuclear magnetic resonances have been studied in powdered samples of the cesium-graphite intercalation compounds at temperatures between 1.3 and 4.2 K. The spin-lattice relaxation times and the lineshapes of both nuclear species in the compounds and of the C-13 nucleus in pure graphite were measured in an effort to determine the electronic nature of these substances. The C-13 T sub 1 in pure graphite at room temperature, measured by a fast passage experiment, is 1.5 + or - 0.4 minutes. Possible relaxation mechanisms are discussed and a relaxation rate is calculated on the assumption that dipole-dipole interactions with electrons in graphite p sub z orbitals are responsible for the relaxation. Solid echos at helium temperatures establish the shape of the 500 G wide cesium quadrupolar spectrum in CsCs at 1.3 K. The Knight shift for cesium in CsCs is measured to be 0.29% + or 0.01%, independent of temperature from 300 to 1.3 K.
Dissert. Abstr.

N71-34516 Rensselaer Polytechnic Inst., Troy, N.Y.
THE EFFECTS OF CARBON FIBER MICROSTRUCTURE ON THE SHEAR STRENGTH OF CARBON-EPOXY COMPOSITES
Barry Lynn Butler (Ph.D. Thesis) 1970 236 p refs
Avail: Univ. Microfilms Order No. 70-19934

The cause of the poor shear strengths of composites of high strength and modulus carbon fibers embedded in epoxy were investigated. Shear strengths were evaluated by loading composite beams with the fibers aligned parallel to the beam axis under three point loading conditions. The shear strength decreases as the fiber modulus is increased. An increase in fiber modulus from 25 to 50 million psi decreases the composite shear strength from 12 to 2 ksi. The failures were shear at the midplane and not tension or compression at the surface. Fracture analyses on the samples indicated that the fiber matrix interface was failing. Thus the carbon fibers' surfaces are changing the composite strengths. The microstructures of the fibers were studied to determine how the surface was changing. The poor penetrating power of electrons, about .2 microns on a 10 micron diameter fiber, allowed surface electron diffraction and dark field electron microscopy to reveal that the basal planes on the surface were parallel to the surface.
Dissert. Abstr.

N71-34517 Wisconsin Univ., Madison.
THE PRESSURE VOLUME TEMPERATURE BEHAVIOR OF AMORPHOUS HIGH POLYMERS AND OLIGOMERS
Joel William Barlow (Ph.D. Thesis) 1970 452 p
Avail: Univ. Microfilms Order No. 70-13902

A bellows-type cell for measuring small volume changes in polymers and liquids was developed. The cell was used to measure the volume changes of water, mercury, and 1,4 polybutadiene between 5 to 55 C and 1 to 3000 atmospheres. A volume dependent Mie form of the lattice energy adequately describes the observed maximum in the internal pressure versus volume relationship. Isochoric curvature occurs for hydrocarbons. Thermodynamic analysis of seven hydrocarbons, C7 through C40, was made. A semiempirical hole theory equation of state was developed which describes the hydrocarbon pressure-volume-temperature data over ranges of 2000 bars and 200 C. An entropic contribution to the internal pressure is suggested as an explanation for the characteristic maximum in the internal pressure versus isothermal volume relationship.
Dissert. Abstr.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N71-34518*# Bellcomm, Inc., Washington, D.C.
UNNORMALIZED ASSOCIATED LEGENDRE FUNCTIONS: A COMPENDIUM OF GRAPHS, EXPANSIONS, PROPERTIES, AND INTEGRALS
W. G. Heffron and S. L. Levie Jr. 16 Aug. 1971 42 p refs
(Contract NASw-417)
(NASA-CR-121744; B71-08018) Avail: NTIS CSCL 12A

A compendium of graphs, expansions, properties, and integrals of the unnormalized associated Legendre functions is submitted.
E.M.C.

N71-34519*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
INVESTIGATION OF SYSTEM READINESS WHEN SOME DEFECT TYPES ARE UNKNOWN
Edwin R. Huber and John E. Walsh 28 Sep. 1970 23 p refs
(Grant NGR-44-007-082; Contract N00014-68-a-0515; Proj. Themis)
(NASA-CR-121615; THEMIS-SMU-TR-82) Avail: NTIS CSCL 12A

A system consists of subsystems and performs satisfactorily when defects in subsystems do not cause its failure. For each subsystem, defect types are identified by their nature and by their level of probabilistic influence on system failure (finite number of levels). The subsystems and possible defect types are so defined that, for satisfactory system performance, a defect type can occur at most once in a subsystem. Also, for this conditional case, probabilities for a defect type are not influenced by occurrence of other defect types. Moreover, the defect types are independent and have small probabilities with respect to occurrence. System ability is represented by the Readiness Index (RI), which is the probability of no defect that causes system failure. Suitable data are available for each combination of subsystem and level of probabilistic influence on system failure. For every combination, the number of defect types occurring is observed over some repetitions. Unbiased estimation, approximate tests and confidence intervals are developed. Author

N71-34520*# Harvard Univ., Cambridge, Mass. Center for Research in Computing Technology.
TERMINAL CONTEXT IN CONTEXT-SENSITIVE GRAMMARS
Ronald V. Book Oct. 1971 26 p refs
(Grants NGR-22-007-176; NSF GJ-803)
(NASA-CR-121497) Avail: NTIS CSCL 12A

It is shown that when certain nontrivial constraints are placed on the form of the rules of a context-sensitive (with erasing) grammar only context-free languages will be generated. The constraints involve the use of terminal strings as part of context. If every non-context-free rule of a context-sensitive (with erasing) grammar has as left context a string of terminal symbols and the left context is at least as long as the right context, then the language generated is context-free. If every non-context-free rule of a context-sensitive (with erasing) grammar has as left and right context strings of terminal symbols, then the language generated is context-free. Author

N71-34521*# Lincoln Lab., Mass. Inst. of Tech., Lexington.
OPTIMAL MEASUREMENT STRATEGIES FOR LINEAR STOCHASTIC SYSTEMS
M. Athans 26 Feb. 1971 42 p refs
(Grants NGL-22-009-124; AF-AFOSR-1724-69; Contract F19628-70-C-0230)
(NASA-CR-119706; TN-1971-12) Avail: NTIS CSCL 12A

Optimization problems are presented for selecting, at each instant of time, one measurement provided by sensors. The basic problem is to select an optimal measurement policy, during a specified observation time interval, so that a weighted combination of prediction accuracy and accumulated observation cost is minimized. The current analysis is limited to the class of linear stochastic dynamic systems and measurement subsystems. An iterative digital computer algorithm is suggested for obtaining numerical results. It is shown that the optimal measurement policy and the associated matched Kalman-type filter can be precomputed, i.e. specified before the measurements actually occur. Author

N71-34522*# Rice Univ., Houston, Tex.
MODIFIED QUASILINEARIZATION METHOD FOR SOLVING NONLINEAR EQUATIONS
A. Miele, S. Naqvi, and A. V. Levy 1970 23 p refs
(Grants NGR-44-006-089; NSF GP-18522)
(NASA-CR-121654; AAR-78) Avail: NTIS CSCL 12A

A general method for solving nonlinear equations of the form phi(x) = 0, where x and phi are n-vectors is presented. The method is based on the consideration of the performance index p, the cumulative error in the equations. A modified quasilinearization algorithm is generated by requiring the variation of the performance index delta p to be negative. This algorithm differs from the ordinary quasilinearization algorithm because of the inclusion of the factor or stepsize alpha in the system of variations. The main property of the modified quasilinearization algorithm is the descent property: if the stepsize alpha is sufficiently small, the reduction in P is guaranteed. Convergence to the desired solution is achieved when the inequality p < or = epsilon is met, where epsilon is a small, preselected number. The variations per unit stepsize delta x/alpha = A are governed by a system of n linear equations, which is solved by Gaussian elimination. Several numerical examples are presented. They illustrate the simplicity as well as the rapidity of convergence of the modified quasilinearization algorithm, and the importance of stepsize control. Author

N71-34523*# Harvard Univ., Cambridge, Mass. Center for Research in Computing Technology.
SUBTREE REPLACEMENT SYSTEMS
Barry K. Rosen May 1971 286 p refs
(Grants NGR-22-007-176; NSF GS-1934)
(NASA-CR-121655; Rept-2-71) Avail: NTIS CSCL 12A

The theory and some applications of subtree replacement systems are presented. The abstract theory of general replacement systems and subtree replacement systems is reviewed as well as extensions of Brainerd's arithmetic of trees and the conditions for the Church-Rosser property in subtree replacement systems. The theory is applied to McCarthy's calculus for recursive definitions, full lambda calculus including eta and delta rules, and finite tree transducers and their use in compiler design. J.M.

N71-34524*# Ohio State Univ. Research Foundation, Columbus. Dept. of Mathematics.
RANKING PROBLEMS IN MULTIVARIATE NORMAL (STATISTICAL) POPULATIONS (FIRST YEAR WORK). NONPARAMETRIC RANGING AND SELECTION PROCEDURES (SECOND YEAR WORK) Final Report, 1 Jul. 1966 - 30 Sep. 1969
M. Haseeb Rizvi 17 Jun. 1971 15 p refs
(Grant NGR-36-008-040)
(NASA-CR-121656) Avail: NTIS CSCL 12A

Selection of the best automation system in terms of reliability, feasibility, and economy is considered, when there are several alternative systems involved. A typical parametric function representing the Mahalanobis distance between two p-variate normal distributions, one with p-vector mean mu and covariance matrix sigma, and another with mean null p-vector and the same covariance matrix sigma is employed. A selection procedure is proposed when the covariance matrices are all known (unknown) and the common number of observations (needed from each of the automation systems) is obtained so that the probability of a correct selection is no less than a preassigned quantity. Some tables are provided for determination of the common sample size for various values of the constants involved. E.M.C.

N71-34525*# Maryland Univ., College Park. Computer Science Center
OUTLINE BIBLIOGRAPHY, AND KWIC INDEX ON MECHANICAL THEOREM PROVING AND ITS APPLICATIONS
Gordon J. VanderBrug, Daniel H. Fishman, and Jack Minker Jun. 1971 54 p
(Grants NGR-21-002-270; NGL-21-002-008; NBS CST-821-5)
(NASA-CR-121648; TR-159) Avail: NTIS CSCL 12A

The significant achievements in mechanical theorem proving applications are outlined. These achievements range from foundational work in the 1920's and 1930's to current efforts. A bibliography and KWIC index on the subject are included. Author

N71-34526*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
STUDY OF DIFFERENT APPROXIMATIONS IN THE CALCULATION OF g-TENSORS: H2(PLUS)
Philippe de Montgolfier and John E. Harriman 31 May 1971 39 p refs Supported in part by NATO

(Grants NGL-50-002-001; NSF GP-12832)
(NASA-CR-121647; WIS-TCI-440) Avail: NTIS CSCL 12A

Some results of g-tensor calculations for the molecular ion H2(+) are presented. The theory of the g-tensor is briefly reviewed. The results of several calculations of some states of unperturbed H2(+) are presented. The first order wave function as computed variationally and in terms of zero order excited states is presented. A computation of the g factor for H2(+) at the equilibrium internuclear separation is given. Special emphasis is placed on the results of the LCAO approximation. The position that the neglect of multicenter terms is very dangerous and that a single value for the spin orbit coupling parameter cannot be used is supported. Author

N71-34527*# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
COMPUTATIONAL COMPARISON OF STRAPDOWN SYSTEM ATTITUDE ALGORITHMS
Fred J. Marcus (M.S. Thesis) Jun. 1971 74 p refs
(Grant NGR-22-009-229; Contract DOT-TSC-143)
(NASA-CR-121731; TE-43) Avail: NTIS CSCL 12A

The accuracies of algorithms are compared by digital simulation of the algorithms' response to specified angular input rates. For constant rate cases, both the direction cosine matrix (D.C.M.) technique and the Euler parameter technique gave rise to linearly growing drift angle errors. The errors incurred by the Euler parameter technique were significantly less than those incurred by the direction cosine matrix scheme. For the cases where the simulated body motions were purely sinusoidal, the drift errors incurred by both techniques were bounded sinusoids having the same periods as the applied angular inputs. The magnitudes of the bounds were again less for those routines using Euler parameters rather than D.C.M. schemes. The magnitudes of the bounds for this case were proportional to the input angular rate raised to the power of the order of the numerical integration scheme employed. Author

N71-34528*# Bellcomm, Inc., Washington, D.C.
VIRTUAL MASS TECHNIQUE FOR COMPUTING N-BODY SOLUTIONS
D. H. Novak 28 Dec. 1970 82 p refs
(Contract NASw-417)
(NASA-CR-121749; TM-70-2011-3) Avail: NTIS CSCL 12A

The fifth order matched acceleration and jerk implementation of the Virtual Mass concept has been developed for n-body problems. Double precision digital computer comparisons have shown it to be a simple, self-starting, fast, and highly accurate method of numerically integrating a spacecraft trajectory. This procedure can handle aspherical gravitational effects of individual celestial bodies, and nongravitational accelerations of the spacecraft such as rocket thrust, solar radiation pressure, and aerodynamic forces. E.M.C.

N71-34529*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
THEORY OF REACTIVE SCATTERING. 6: VOLTERRA EQUATION FORMALISM FOR COUPLED CHANNEL AMPLITUDE DENSITIES AND MODIFIED WAVEFUNCTIONS
Donald J. Kouri (Houston Univ.) 28 Jul. 1971 24 p refs
(Grants NGL-50-002-001; NSF GP-18872)
(NASA-CR-121759; WIS-TCI-447) Avail: NTIS CSCL 12A

The homogeneous integral solution procedure of Sams and Kouri is applied to integral equations derived using the coupled channel operator formalism. It is shown how Volterra integral equations of the second kind may be obtained for solving the equations for a modified channel wavefunction (or the channel amplitude density). The modified channel wave function is found to behave like the scattered portion of the wave function. Author

N71-34530*# Wisconsin Univ., Madison. Dept. of Chemistry.
ON THE NONITERATIVE SOLUTION OF INTEGRAL EQUATIONS FOR SCATTERING OF ELECTROMAGNETIC WAVES
Donald J. Kouri 23 Jul. 1971 17 p refs
(Grants NGL-50-002-001; NSF GP-18872)
(NASA-CR-121760; WIS-TCI-448) Avail: NTIS CSCL 12A

The scattering of electromagnetic waves is considered using the integral equation form of Maxwell equations for the electric field. The homogeneous integral solution procedure of Sams and Kouri is adapted to these field equations to derive Volterra integral equations of the second kind for modified field functions. A quadrature solution procedure is examined for the solution of the Volterra equations and its merits discussed. Author

N71-34531*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.
NON-PARTIAL WAVE TREATMENT OF REACTIVE AND NONREACTIVE SCATTERING: COUPLED INTEGRAL EQUATIONS FORMALISM
Edward F. Hayes (Rice Univ.) and Donald J. Kouri (Houston Univ.) 28 Jul. 1971 12 p refs Supported in part by NSF
(Grant NGL-50-002-001)
(NASA-CR-121761; WIS-TCI-449) Avail: NTIS CSCL 12A

Coupled integral equations are derived for the full scattering amplitudes for both reactive and nonreactive channels. These coupled integral equations are similar in nature to equations derived for purely nonreactive collisions of structureless particles. Using numerical quadrature techniques, these equations may be reduced to simultaneous algebraic equations which may then be solved. Author

N71-34532*# National Aeronautics and Space Administration, Washington, D.C.
THEORETICAL AND APPLIED MATHEMATICS: A COMPILATION
[1971] 26 p refs
(NASA-SP-5933(01)) Avail: NTIS CSCL 12A

A compilation of papers are presented that deal with the following: (1) mathematical applications for the resolution of problems encountered in numerous industries, and (2) computer programs which can be applied to resolve computational problems swiftly and accurately. D.L.G.

N71-34533# National Aeronautical Lab., Bangalore (India).
ON THE SPLINE APPROXIMATION FOR INTEGRALS WITH A LOGARITHMIC KERNEL
V. V. Shanbhag and R. Narasimha May 1970 8 p refs
(NAL-TN-27) Avail: NTIS

A method based on cubic spline approximation is given for evaluating integrals of the type integral from 0 to 1 of f(x) ln x dx when f(x) is given at some discrete points. A few tests on examples of aerodynamic interest showed that the accuracy of this method is superior to that obtainable from currently available Gaussian formulas. Author

N71-34534# National Research Council of Canada, Ottawa (Ontario).
CONVERGENCE OF GALERKIN METHOD FOR NONLINEAR EQUATIONS [SKHODIMOST METODA GALERKINA DLYA NELINEINYKH URAVNENII]
M. A. Krasnoselskii 1971 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 73, no. 6, 1960 p 1121-1124
(NRC-TT-1454) Avail: NTIS

The applicability of the Galerkin method to the construction of approximate solutions of nonlinear operator equations is discussed. The equation phi = A phi was examined assuming it had an isolated solution of the nonzero index. If the isolated solution is not the only solution of the equation then the entire investigation is carried out for the elements from a certain sphere T is contained in E, in which the equation has no solution except phi sub 0. Theorems and proofs are given. E.H.W.

N71-34535# California Univ., Livermore. Lawrence Radiation Lab.
FUNCTION OPTIMIZATION ON A LINE SEGMENT BY GOLDEN SECTION
Robert F. Hausman, Jr. 1 Apr. 1971 8 p refs
(UCID-30002) Avail: NTIS

A subroutine, GOLDEN, is presented, which uses the method of golden section to reduce the length of an interval in which an extremum of a function is located. The GOLDEN routine searches the input interval for a minimum of a user supplied function and may be used to find maxima by noting that a maximum of a function f(x) is a minimum of the function -f(x). GOLDEN is designed for use in situations where the evaluation of the first derivative of the objective function is impossible, or very expensive relative to evaluation of the objective function itself. Author

N71-34536# Joint Publications Research Service, Washington, D.C.
PRINCIPLES AND APPLICATION OF SITUATION CONTROL
26 Aug. 1971 26 p refs Transl. into ENGLISH from Tekhn. Kibernetika, IAN (Moscow), No. 2, Mar. - Apr. 1971 p 10-25
(JPRS-53913) Avail: NTIS

CONTENTS:
1. PRINCIPLES OF SITUATION CONTROL D. A. Pospelov p 1-13 (See N71-34537 21-19)
2. PRACTICAL APPLICATION SITUATIONAL CONTROL MODELS L. S. Zagadskaya, Yu. I. Klykov p 14-25 (See N71-34538 21-19)

N71-34537# Joint Publications Research Service, Washington, D.C.
PRINCIPLES OF SITUATION CONTROL
D. A. Pospelov *In its* Principles and Appl. of Situation Control 26 Aug. 1971 p 1-13 refs (See N71-34536 21-19)
Avail: NTIS

A control method for complex systems, based on the construction of a generalized model of the description of the structure and operation of the control system is considered. In the construction of the model, the device of formal generative and transformational grammars is used. Author

N71-34538# Joint Publications Research Service, Washington, D.C.
PRACTICAL APPLICATION OF SITUATIONAL CONTROL MODELS
L. S. Zagadskaya et al *In its* Principles and Appl. of Situation Control 26 Aug. 1971 p 14-25 refs (See N71-34536 21-19)
Avail: NTIS

Application of situational control models are examined for a wide class of large systems: lock sections of canals, seaports and airports, networks of street crossroads, and others. The basic principles of situational control on a TsVM (digital computer) are also discussed, and experimental results are presented. Author

N71-34539# Middle East Technical Univ., Ankara (Turkey).
SYMBOLIC LOGIC, VOLUME 2
Teo Gruenberg 1970 156 p refs
(Publ-16-vol-2) Avail: NTIS

For abstract, see N71-34547.

N71-34540# Technische Hogeschool, Delft (Netherlands). Lab. for Aero and Hydrodynamics.
OBJECTIVE OPERATIONS IN THE CLASSICAL CONTINUUM THEORY
H. J. Merk Jun. 1971 44 p refs
(WTHD-25) Avail: NTIS

The problem of the definition of objective (or frame-indifferent) time fluxes is treated. In the Euclidean space these can be defined in terms of linear operations called shifting. The inverse of the objective time flux is the objective integration along path lines which processes can also be constructed by means of shifting. The shifting, differentiation, and integration of vectors are discussed. The operations are derived for tensors of second order. The covariant and contravariant convected time fluxes and integrations are derived from the general equations. The rotation tensor of the deformation theory is used to derive the co-rotational time fluxes. The choice of a particular shifting rule cannot be uniquely determined by the kinematics of the continuum theory, but may be justified by the simpler formulations of special equations. The theory allows for a systematical introduction of the object kinematical tensors. A generalization of the usual objective time fluxes is discussed. Author

N71-34541# RAND Corp., Santa Monica, Calif.
A TWISTED TURNPIKE
E. B. Keeler Nov. 1970 18 p refs
(P-4493) Avail: NTIS

McKinzie's version of the Morishima no-joint-production turnpike theorem was used to see how much of the theory is retained if the production possibilities vary with time. With the assumptions that normalized production have bounds, and there is no joint production, it is shown that if the transformation sets are weakly positive, the diameter of the set of prices associated with efficient paths approaches zero, and if the isoquants are uniformly convex, long efficient paths are close to each other. F.O.S.

N71-34542# RAND Corp., Santa Monica, Calif.
FIELD TESTING: METHODOLOGICAL CONSIDERATIONS AND A SPECIFIC EXAMPLE
T. S. Donaldson and R. J. Kaplan Nov. 1970 20 p refs
Presented at 16th Conf. on the Design of Expt. in Army Res. Develop. and Testing, Fort Lee, Va., 21-23 October 1970
(P-4492) Avail: NTIS

The characteristics of field research methods are discussed including degrees of test control, tradeoffs, test purposes, and serendipity. A specific problem, Air Defense Command dispersal planning, is outlined and methods used in estimating sample size, the general experimental design, and selection of independent variables are shown. The study results are summarized and discussed. J.M.

N71-34543# Maryland Univ., College Park. Computer Science Center.
CONJECTURES ON THE PERCEPTION ELONGATION
E. S. Deutsch Feb. 1971 27 p refs
(Contract AT(40-1)-3662)
(TR-149) Avail: NTIS

The problem of the perception of length is discussed together with some known illusions. The difference is drawn between image contraction and image thinning. It is proposed that length is perceived by a mechanism which first forms a minimal closed path (hull) around the object and then performs an isotropic image reduction operation on the hull of the image. The elongation of the image is exemplified in the resulting path. No path should result if the original image possesses no elongation. The conjecture is used to explain the known illusions discussed and a few new ones are suggested. An isotropic image reduction technique is described and experimental results obtained using a variety of images are presented to test the conjecture. Author

N71-34544# Technische Hogeschool, Eindhoven (Netherlands).
ON THE RANGE OF VALIDITY OF AN APPROXIMATION METHOD FOR SOME WAVE EQUATIONS
Martinus Franciscus Hendrikus Schuurmans (Ph.D. Thesis) 2 Feb. 1971 138 p refs
Avail: NTIS

The Burger and Kortweg-de Vries nonlinear dissipative and dispersive wave equations are discussed. Simple wave approximations are outlined for a nonlinear problem and a set of diffusive wave equations with emphasis on the validity range of the approximation. A numerical study of an initial value problem for a set of diffusive wave equations is presented as well as a continuum representation for the linear chain problem. A simple wave approximation of a set of linear dispersive wave equations is also included. J.M.

N71-34545# RAND Corp., Santa Monica, Calif.
CALCULATING k-th SHORTEST PATHS
B. L. Fox Apr. 1971 5 p refs
(P-4638) Avail: NTIS

An improved method for calculating k-th shortest paths is presented. A modification for k > 2 improves the efficiency of the algorithm. An integer programming application is mentioned. Author

N71-34546# Technische Hogeschool, Delft (Netherlands).
FERMAT PSEUDO PRIMES
Erik Lieuwens (Ph.D. Thesis) 21 Apr. 1971 72 p refs
Avail: NTIS

The main problem investigated is to find odd composite numbers m which satisfy the expression: 2 to the (m-1) is congruent to 1 (mod m). Theorems on primes are generalized, and a construction is given of composite numbers which for all positive integers a satisfy a to the mth is congruent to a (mod m). An alternate formulation of the main problem is given suggesting that there are theorems which give information on which elements of a second order recurring sequence u sub 0 = 0, u sub 1 = 1, u sub (n+2) = au sub (n+1) + bu sub n, are divisible by a given prime p. It is then investigated whether similar properties are satisfied also by composite integers m. The Fibonacci sequence and the associated Fibonacci sequence are studied and are generalized to arbitrary second order recurring sequences. The question is then taken up whether there exist composite numbers which satisfy a prime relation for every second order recurring sequence. Properties are described of second order recurring sequences, and are extended to the kth (k greater than 2). For the special case k = 2, some restrictions are given about the divisors of such a possible composite number. Author

N71-34547# Middle East Technical Univ., Ankara (Turkey).
SYMBOLIC LOGIC, VOLUME 1
Teo Grunberg 1969 153 p refs
(Publ-16-vol-1) Avail: NTIS

Lectures for intermediate and advanced courses on symbolic logic are presented. The fundamentals of sentential and quantificational logic are discussed from the point of view of validity, consistency, equivalence, and implication. Normal forms and duality are investigated in detail, and emphasis is put on decision procedures and on transformations. Inference is considered extensively, along with the process of deduction in sentential and quantificational logic, the natural deduction approach being preferred to the classical one. In the study of elementary theory of classes and relations, emphasis is again laid on decision procedures and transformations. A free substitution operation is introduced, and Boolean class theory is discussed with respect to its relationship to sentential logic and to monadic quantificational logic. In the advanced section, the basic concepts of semiotic, such as use and mention, or object language and metalanguage, are considered. Concepts of computability, enumerability, and decidability are defined. Simple and natural algorithms, syntax and semantics of first-order axiomatic theories, and the concept of a model are discussed. Author

N71-34548# Royal Aircraft Establishment, Farnborough (England).
A RECURRENCE RELATION FOR INCLINATION FUNCTIONS
R. H. Gooding Apr. 1970 13 p refs
(RAE-TR-70074) Avail: NTIS

When the terms of the series expansion for the gravitational potential of the earth are expressed in terms of the orbital elements of an arbitrary earth satellite, the orbital inclination, i, appears in each term as the argument of a function of inclination only. For the special case when the field is axisymmetric, a recurrence relation is given for a general normalized function with three parameters. Author

N71-34549# Oak Ridge National Lab., Tenn.
GEOMETRIC PROPERTIES OF SOLUTIONS OF THE DIFFERENTIAL SYSTEM x' EQUALS Ax
Manuel Feliciano, Jr. (Ph.D. Thesis) May 1971 128 p refs
(Contract W-7405-eng-26)
(ORNL-4686) Avail: NTIS

The problem of determining the lowest dimensional flat that contains the solution of the differential system x' = Ax x(0) = c is discussed, where A is a real constant n-by-n matrix. A flat is a subset of a vector space of the form v + L sub o where v is fixed vector and L sub o is a subspace. Jordan decompositions were obtained for the n-dimensional vector space over the real field and that over the complex field. A relationship was established between these decompositions. The results were used to calculate the solution of the above system and serve as background for the problem for the problem. Author

N71-34550# Technische Hochschule Munchen (West Germany).
GENERALIZED DIFFERENTIAL EQUATIONS FOR SOLVING OPTIMIZATION PROBLEMS [VERALLGEMEINERTE DIFFERENTIALGLEICHUNGEN ZUR LOESUNG VON OPTIMIERUNGSAUFGABEN]
Walter Schlee (Ph.D. Thesis) 14 Dec. 1970 87 p refs In GERMAN
Avail: NTIS

The solution for a differential equation is parameterized in such a way that the optimal solution curves for the differential equation as developed by analog computer are still mathematically feasible. The theory of multiple-value differential equations is used for these calculations. Transl. by G.G.

N71-34551*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Aero-Astrodynamics Lab.
DESIGN OF COMPUTATIONAL ALGORITHMS FOR OPTIMAL CONTROL BY HILBERT SPACE
William A. Gruver, III Washington Aug. 1971 112 p refs
(NASA-TN-D-6260; M-168) Avail: NTIS CSCL 12A

Three computational algorithms are developed as well as time-varying, first order systems designed for testing these algorithms. (1) Concepts of asymptotic stability and Hamilton-Jacobi theory are used to obtain a sequence of functionals convergent to optimal cost. The method is applied to the state regulator problem, and an algorithm is obtained that requires solving linear differential equations instead of nonlinear Riccati equations. (2) This algorithm inherits the advantages of the quasi-Newton method employed including rapid and stable descent to a minimum. The inverse Jacobian is obtained by iteration, and only first-order partial derivatives of the cost functional are required. (3) A second-variation algorithm is developed which avoids the use of adjoint functions and the Hamiltonian formulation. Two methods for solving the associated boundary value problem are developed in detail. Finally, computational examples describe the application of each algorithm, and comparisons are made with the exact solutions. E.M.C.

N71-34552# Syracuse Univ., N.Y.
NEWMAN-PENROSE CONSTANTS AND THEIR INVARIANT TRANSFORMATIONS

Edward N. Glass and Joshua N. Goldberg [1969] 94 p refs Sponsored in part by NSF
Avail: NTIS

The origin and significance of the Newman-Penrose constants of the motion are examined from the point of view that constants of the motion generate invariant transformations. In this case the calculation makes use of a generalization of Green's Theorem to a situation applicable to the coupled Einstein-Maxwell fields in general relativity. Strictly electromagnetic constants are found to be generated by an incoming electromagnetic shock wave, with dipole symmetry, at future null infinity. The gravitational constants contain an admixture from the electromagnetic field. They are generated by an incident quadrupole gravitational shock wave at future null infinity. Both the electromagnetic dipole field and the gravitational quadrupole field behave like linearized fields at null infinity. All higher multipole fields do not uncouple from the non-linear corrections induced by the self-coupling of the gravitational field and its coupling with the electromagnetic field. It is shown that the gravitational constants are related to the rate of shear of the null rays near null infinity a result which suggests a connection with sources. Finally the super-translation invariance of the result is discussed. Author

N71-34553 National Landing Library for Science and Technology, Boston Spa (England).
POINT ESTIMATION OF VARIANCES OF INDEPENDENT AND CORRELATED MEASUREMENTS BY THE METHOD OF LEAST SQUARES
I. I. Poljak [1971] 7 p ref Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), v. 267, 1970 p 107-116
(NLL-M-20658-(5828.4F)) Avail: Natl. Landing Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Point estimates of standardized variances of measurements are made, based on new developments in the least squares method which make it possible to allow for correlation between measurements in the construction of approximation functions. Polynomial estimation of equally spaced measurements is discussed, and graphs of estimated variances for measurements which are not equally spaced are given. N.E.N.

N71-34554 Stanford Univ., Calif.
PARAMETER IDENTIFICATION AND STATE ESTIMATION FOR LINEAR SYSTEMS
Michael Allan Budin (Ph.D. Thesis) 1970 88 p
Avail: Univ. Microfilms Order No. 70-18381

By investigating the structure of linear systems, a direct procedure which is computationally superior to previous solutions is developed for obtaining the model of a linear, time invariant system from input/output observations. Application of this procedure does not require that the inputs be impulses or that the system dimension be known. The need to differentiate input and output observations for continuous system modeling is eliminated in this solution. The system structure is well specified and can be used as a check on the model obtained. Based on the deterministic solution, three distinct consistent identifiers are developed for obtaining the model of a linear system when the input and output observations are corrupted by noise. The problem of state estimation is solved using constant gain observers. A method of finding a constant gain to yield arbitrary error dynamics is presented for the case when the system model is known and the observations are noise free. Dissert. Abstr.

N71-34555 Washington Univ., St. Louis, Mo.
SUBOPTIMAL CONTROL BY AGGREGATION
Robert B. Schainker (Ph.D. Thesis) 1970 99 p
Avail: Univ. Microfilms Order No. 70-18955

The suboptimal regulator control of linear systems is studied using a reduced dimensional aggregated state vector. Three suboptimal policies are developed. The first can be applied to time-varying and time-invariant systems and depends on an nth order Riccati equation to determine the control law that actuates an nth order process via a reduced mth order aggregated state vector. The second suboptimal policy control law depends on the solution of an mth order Riccati equation of the aggregated model. The third policy presents a method of controlling a time-invariant process where the only measurements available are made through an observation vector. All the terms of this dynamic model are shown to be analytically solvable in convenient forms. Dissert. Abstr.

N71-34556 Purdue Univ., Lafayette, Ind.
ON METHODS OF CALCULATING NONINFERIOR PERFORMANCE INDEX VECTORS
Robert William Reid, Jr. (Ph.D. Thesis) 1970 214 p
Avail: Univ. Microfilms Order No. 70-18718

Several explicit methods for calculating noninferior performance index vectors are investigated. The vector performance index under consideration consists of N scalar index elements of the LaGrange type, and the problem is to find the noninferior index vectors and their controls from among the set of admissible index vectors which correspond to admissible controls. The vector performance index problem is first converted to a scalar index problem by forming an auxiliary scalar index as a function of the vector index and a vector of weighting parameters. The family of scalar index problems is then solved for a finite range of weighting vector values in an effort to determine the functional relationship between the noninferior index vectors and the various weighting vectors. An alternate approach is applied to the unconstrained auxiliary index problem in the form of a Taylor's series expansion. Dissert. Abstr.

N71-34131*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
GENERATION OF THE FORD SEQUENCE OF LENGTH 2 TO THE nth POWER, n LARGE
H. Fredricksen *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 84-85 refs (See N71-34118 21-07)
Avail: NTIS CSCL 12A

N71-34132*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
WEIGHTS IN THE THIRD-ORDER REED-MULLER CODES
H. van Tilborg *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 86-94 refs (See N71-34118 21-07)
Avail: NTIS

N71-34134*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ON THE BLIZARD DECODING ALGORITHM
L. R. Welch (Univ. of Southern Calif.) *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 101-104 refs (See N71-34118 21-07)
Avail: NTIS CSCL 12A

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-34557*# South Dakota School of Mines and Technology, Rapid City.
METEOROLOGICAL OBSERVATIONS REQUIRED FOR FUTURE WEATHER MODIFICATION PROGRAMS Inst. Of Atmospheric Sciences.
K. R. Biswas and A. S. Dennis Apr. 1971 121 p refs
(Grant NGL-42-001-004)
(NASA-CR-121817; Rept-71-5) Avail: NTIS CSCL 04B

A survey has been made of the literature on weather modification experiments carried out in several countries on a

scientific basis. An attempt has been made to bring out the pertinent meteorological variables that were found most useful in conducting and evaluating the experiments for particular types of cloud systems and for the particular regions concerned. Emphasis has been placed on specifying the meteorological observations required as input data for computer models describing weather modification experiments. The facts that have emerged from the present study are: (1) certain meteorological variables must be observed in all types of weather modification projects and spatial resolution requirements do not vary greatly with the objective; (2) the observations required are, in general, those required for accurate forecasting of the meteorological phenomena being treated except that increased emphasis must be placed upon condensation and ice nuclei and the composition of clouds; (3) the requirements go far beyond what can be achieved with existing networks in terms of spacing and frequency of observations. Author

N71-34558# Kernforschungszentrum, Karlsruhe (West Germany).

CONTRIBUTION OF POOR EXCHANGE WEATHER CONDITIONS TO THE RADIATION BURDEN OF THE ENVIRONMENT OF ATOMIC ENERGY FACILITIES

L. A. Koenig Dec. 1970 14 p In GERMAN

(KFK-1338) Avail: AEC Depository Libraries

A method is described which allows the evaluation of the influence of meteorological conditions, e.g., low wind speed and weak vertical mixing, on radioactivity in the environment of nuclear facilities. The method requires the availability of results derived from dose calculations, the weather conditions, and wind statistics broken down by direction and velocity. The method is applied to the Karlsruhe Nuclear Research Center site and reveals, in this particular case, a negligible influence for weather conditions. Author (NSA)

N71-34559# Weapons Research Establishment, Salisbury (Australia).

A METHOD FOR THE REAL TIME ESTIMATION OF WIND VELOCITIES AT HEIGHTS ABOVE THE CEILING OF METEOROLOGICAL BALLOONS

S. G. Johnson Jan. 1971 27 p refs

(TN-HSA-I67) Avail: NTIS CSCL

The position of a dropsonde parachute, the wind sensor, is determined by high precision radar, and the velocity of the sensor is determined using a digital impact predictor. Velocities and corresponding heights of the sensor are displayed on a plotting table, and by use of a very simple technique, the zonal and meridional components of the wind estimates are established. The results of three trials carried out at Woomera in the period October to December 1969 are reported. Author

N71-34560# Japan Meteorological Agency, Tokyo.

AEROLOGICAL DATA OF JAPAN, JULY 1969

1970 296 p refs

Avail: NTIS

Tables of upper air data observed in Japan and its vicinity are presented. The data are corrected for temperature error due to solar radiation and the effect of low temperature on the vacuum cell, and the curvature of the surface of the earth is taken into account in the computation of upper winds. The tables include: (1) standard pressure levels, (2) temperature and humidity significant levels, (3) wind significant levels, and (4) pilot-balloon data. D.L.G.

N71-34561# Deutscher Wetterdienst, Offenbach am Main (West Germany).

CLIMATOLOGICAL SITE MAPPING OF MAP SCALE TABLE REGION DISPLAYED IN AN EXAMPLE OF FROST DANGER FOR THE AHRENSBURG AREA [GELAENDEKLIMAKARTIERUNG EINES MESSTISCHBLATTBEREICHES DARGESTELLT AM BEISPIEL DER FROSTGEFAEHRDUNG DES BEREICHES AHRENSBURG]

Ernst Franken 1970 38 p refs In GERMAN; ENGLISH summary its Berichte des deutschen wetterdienstes nr. 119

Avail: NTIS

In spite of the flat landscape and the nearby North Sea frosts are often occurring at certain sites of North Germany. Trying to get an idea of the problem and to find out the causes for the differences between different parts of a district the temperature and the relative humidity of certain sites during a period of ten years are discussed. Evaluating the differences between the stations during nights of radiation and by setting them in relation to the direction and velocity of the wind and to the cloudiness observed at a nearby point, some connections were found. Primarily the differences are of practical importance in spring and autumn. It is shown that they are mostly bound to northerly winds which are colder than wind from other directions. Furthermore the air masses coming into the region of Hamburg with cold northerly winds are generally connected with a lower amount of clouds, low vapour pressure and northerly winds additionally tend to abate at night. These are the conditions for obtaining great differences of the temperature of different sites and for frost in unfavourable regions. Based on longterm observations of nearby climatic stations, the sites were evaluated in order to demonstrate the probability of the occurrence of frost after fixed days of spring and before corresponding days of autumn. Author

N71-34562# National Weather Service, Silver Spring, Md. System Development Office.

SOME EXPERIMENTS WITH A FINE-MESH 500-MILLIBAR BAROTROPIC MODEL

Robert J. Bermowitz Aug. 1971 22 p refs

(NOAA-TM-NWS-TDL-42) Avail: NTIS

The quality and accuracy of 500-mb barotropic predictions that use a fine grid in the analysis and forecast are compared to predictions which use coarse mesh. Fine-mesh, 500-mb predicted heights are used in the subsynoptic advection model (SAM), and the accuracy of the resulting categorical precipitation forecasts compared to those from the operational SAM which uses 500-mb forecasts from the primitive equation model. Statistical verification of 14 cases shows: (1) a slight decrease in accuracy of predicted 500-mb heights when the fine mesh is used in either the 500-mb forecast, or in both the 500-mb analysis and forecast, and (2) improvement of categorical forecasts of precipitation in the summer season, but not in the winter season, when fine mesh, 500-mb heights, predicted from an initial state analyzed on the fine grid, are used in SAM. Author

N71-34563# Freie Univ., Berlin (West Germany). Institut fuer Meteorologie und Geophysik.

METEOROLOGICAL DATA. VOLUME 106, NO. 2: DAILY AND MONTHLY NORTHERN HEMISPHERE 10-MILLIBAR -SYNOPTIC WEATHER MAPS OF THE YEAR 1969, PART 2 Quarterly Technical Status Report, Apr. -Jun. 1969

Dietrich Just, Barbara Kriester, Karin Labitzke, Renate Lenshow, and Karin Petzoldt 1970 113 p

(Contract DAJA37-70-C-2330)

(AD-721909; GTSR-2) Avail: NTIS CSCL 04/2

The present volume continues the series of stratospheric weather maps published since 1957 in the Meteorologische Abhandlungen of the Meteorological Institute of the Free University. It contains daily height and temperature analysis of constant pressure levels for three months for the whole of the northern hemisphere, based on rawinsonde and in the upper stratosphere also on rocketsonde data and performed with the aid of a hydrostatic build-up method. The corresponding monthly mean maps, their variations and deviations are included as well as the mean gridpoint data, calculated from daily values. Moreover, the stratospheric circulation of polar, middle, and tropical latitudes is described for the period under consideration. Author (GRA)

N71-34564# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 103, NO. 3: WEATHER SATELLITE OBSERVATIONS AND THEIR EVALUATION. THE EUROPEAN CLIMATOLOGY 1969, PART 3 [METEOROLOGISCHE ABHANDLUNGEN. BAND 103, HEFT 3: WETTERSATELLITENBEOBACHTUNGEN UND IHRE AUSWERTUNG. DAS EUROPAEISCHE WETTERBILD 1969]
Ingrid Haupt, Bernhard Lindenbein, and Ute Katergiannakis 1970 267 p refs In GERMAN; ENGLISH summary
(QR-3) Avail: Issuing Activity

The results of the weather satellite observations made in Berlin during the third quarter of 1969 are presented. The twelfth plenary meeting of the Committee on Space Research (COSPAR) which was held in Prague in May 1969 is reported. Some general remarks about COSPAR and the Global Atmospheric Research Program and some comments about the launching of ATS 5 are included. Daily weather photographs and the orbital data from ESSA 8 and Nimbus 3 are given. Author

N71-34565# Institut Royal Meteorologique de Belgique, Brussels.
ATMOSPHERIC ICE PARTICLES [LES PARTICULES DE GLACE ATMOSPHERIQUES]
L. Dufour 1970 62 p refs In FRENCH *Its* Publ. Ser. B, no. 61
Avail: NTIS

The classification of ice crystals in the atmosphere according to varying forms and dimensions is discussed. The physical properties, effects of saturation pressure, and variations of critical mass by diffusion are also discussed.
Transl. by E.H.W.

N71-34566*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CLOUD COMPARISONS BETWEEN APOLLO 6 PHOTOGRAPHY AND ATS 3 AND ESSA 3 PHOTOGRAPHY
William E. Shenk Washington Oct. 1971 39 p refs
(NASA-TN-D-6470; G-1040) Avail: NTIS CSCL 04B

Concurrent data obtained via ATS 3 and ESSA 3 and from Apollo 6 high-resolution photography are compared. The spatial-resolution ratio between the Apollo 6 data and the data from the other satellites is about 50.1. Though the original ATS 3 cloud cover estimates are 13 to 14 percent higher than the Apollo 6 estimates (primarily in areas of low cumuliform clouds), corrections for the viewing perspective and spatial resolution bring the former estimates to within 5 percent of the latter. These results tend to confirm recent calculations made from satellite measurements of about 30 percent for the earth albedo. Cloud cover estimates made from the ESSA 3 satellite data are lower than the concurrent Apollo 6 data. Cloud type distributions are obtained via normal and stereographic viewing of Apollo 6 picture pairs for a strong midlatitude cold front and for tropical and subtropical regions. Most of the cloudiness is shown to be high or low, with middle cloudiness confined to large, organized weather systems. Author

N71-34567# Sperry Rand Research Center, Sudbury, Mass.
THREE RADIOMETRIC DATA ANALYSIS TECHNIQUES FOR MEASURING AIR TEMPERATURE PROFILES Final Report, 23 Jun. 1969 - 23 Oct. 1970
W. D. Mount, B. R. Fow, C. V. Wick, and C. M. Maloy 23 Oct. 1970 111 p refs
(Contract CPA-22-69-116)
(PB-199412; SRRC-CR-70-27; APTD-0673) Avail: NTIS CSCL 04B

The problem of determining the height of the base, the intensity, and the thickness of an elevated inversion layer from radiometric thermasonde data is discussed. Three advanced radiometric data analysis techniques emphasizing the detection and measurement of these salient features of elevated inversions are proposed. The techniques include: (1) a statistical procedure for finding the best three-straight-line representation of the true profile from the radiometric data - called the gradient altitude model; (2) a relaxation procedure for finding the ambient temperature at sixteen preselected heights from the surface to 2.54 km; and (3) several analog and empirical techniques for detecting the presence and determining the base heights and other features of an elevated inversion directly from the recorder outputs of thermasonde data. The initial development and elevation of these techniques using simulated and real data are presented. Author (GRA)

N71-34568# Johns Hopkins Univ., Baltimore, Md. Center for Research in Scientific Communication.
PRODUCTION, EXCHANGE, AND DISSEMINATION OF INFORMATION PRESENTED IN JOURNAL ARTICLES ON METEOROLOGY
Jun. 1970 68 p refs
(PB-199477; JHU-CRSC-15) Avail: NTIS CSCL 05B

The John Hopkins University Center for Research in Scientific Communication conducted three studies on the flow process of information presented in journal articles on meteorology. The major findings were: There is a two-year (on the average) time lag between initiation and publication of work. The time lag between initiation and publication of work shortens if the work reported deals with theoretical issues, has not been rejected previously by another journal, or is published in a monthly or bimonthly rather than in a quarterly. Work is disseminated faster in the informal network than in the formal network. GRA

N71-34569# National Oceanic and Atmospheric Administration, Boulder, Colo. Atmospheric Physics and Chemistry Lab.
COMPUTER SUBROUTINE FOR PRESENTING METEOROLOGICAL FLIGHT DATA ON THE PRINTER (CURVPT)
Heinz H. Grote Mar. 1971 24 p
(NOAA-TR-ERL-199-APCL-17) Avail: SOD $0.35

A subroutine CURVPT is described that provides a plot on the peripheral printer of up to six parameters with curve separation and automatic scaling. It was developed for automatic presentation of meteorological flight data by the computer but can be used universally. Author

N71-34570# National Oceanic and Atmospheric Administration, Boulder, Colo.
PLOTTER SUBROUTINE FOR METEOROLOGICAL STRAIGHT LINE FLIGHT DATA (SLENDER)
Heniz H. Grote Mar. 1971 55 p refs Revised
(NOAA-TR-ERL-140-APCL-10) Avail: SOD $0.55

A subroutine, SLENDER, is described that works in connection with the plotting subroutine CRTPLT to provide a two-dimensional plot of a relatively straight flight path and four analog traces of selected meteorological parameters lined up with the flight path. Author

N71-34571# National Oceanic and Atmospheric Administration, Boulder, Colo.
PLOTTER SUBROUTINE FOR METEOROLOGICAL FLIGHT PATH (PATH)
Heinz H. Grote Mar. 1971 41 p refs Revised
(NOAA-TR-ERL-139-APCL-9) Avail: SOD $0.35

A subroutine, PATH, is described that works in connection with the plotter subroutine CRTPLT to provide a two-dimensional plot of a meteorological flight path with wind vectors, time notations, and a legend. A coordinate network can be added with subroutine COGRID. Author

N71-34572 National Lending Library for Science and Technology, Boston Spa (England).
THE ACCURACY OF OBJECTIVE ANALYSES OF CONTOUR CHARTS MADE BY THE WEATHER SERVICES OF DIFFERENT COUNTRIES

K. M. Lugina et al [1971] 9 p refs Transl. into ENGLISH from Glav. Geof. Obs., (Leningrad), v. 267, 1970 p 5-15
(NLL-M-20657-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The accuracies of 500 mb charts produced in eight countries are compared. The root mean square differences and correlation coefficients between the observed geopotentials and the interpolated values are used in the analysis. The meteorological charts studied were made in the USSR, USA, France, Japan, Sweden, Norway, Finland, and Belgium. Those charts from Sweden, the USSR, and the USA are considered to be the most accurate, with the Japanese charts also being accurate for Japan. N.E.N.

N71-34573 National Lending Library for Science and Technology, Boston Spa (England).
THE INTERPRETATION OF AUTOGRAPHIC RAINFALL RECORDS WITH A VIEW TO DETERMINING DESIGN RAINFALLS FOR STORM WATER DRAINS
E. Bucuta [1971] 30 p refs Transl. into ENGLISH from Hidrotch. Gospodarirea Apelor Meteorol. (Bucharest), v. 15, 1970 p 13-29
(NLL-M-20659-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The principles underlying the design of sewer systems for draining storm water are described, and the method currently used in Rumania for interpreting and analyzing rainfall data is discussed. The capacity of the sewer system, the use of the land, the flow of water, and the amount of rainfall during storms are considered. The method is illustrated using Bucharest and its meteorological data for 1953 to 1967. N.E.N.

N71-34574 National Lending Library for Science and Technology, Boston Spa (England).
DESCRIPTION OF THE SYNOPTIC SITUATION BY MEANS OF CENTERS OF GRAVITY OF SETS OF PRESSURE SYSTEMS
G. V. Lenova [1971] 16 p refs Transl. into ENGLISH from Gidromet., Nauch. Issled. Cent. SSSR (Leningrad), v. 62, 1970 p 3-17
(NLL-M-20653-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The results are presented of a numerical analysis of daily data on the positions of centers of gravity of cyclones and anticyclones and their space-time characteristics. The data were obtained from daily synoptic charts for the region corresponding to the first natural synoptic region from 1951 to 1960. The frequencies of the centers of gravity were calculated for each month for each part of the region, along with the gradient vector determining the relative position of the centers and data on the air masses. It was found that the centers of gravity of anticyclones were most often observed over the southwest of the region and least often over the northeast and southeast; those of depression were most frequent over the northwest and least frequent over the southeast. Above and below normal frequencies of air mass distributions and air mass transfer directions were found to alternate in the same way already used in making long range weather forecasts. N.E.N.

N71-34575 National Lending Library for Science and Technology, Boston Spa (England).
ANALYSIS OF THE RHYTHMICAL ACTIVITY OF THE ATMOSPHERE FOR FORECASTING AN EXTREME TEMPERATURE FIELD IN FEBRUARY
S. G. Hesina 2 Mar. 1971 16 p refs Transl. into ENGLISH from Gidromet., Nauch. Issled. Cent. SSSR (Leningrad), v. 62, 1970 p 27-37
(NLL-M-20355-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The development of a method of forecasting large anomalies of the monthly mean temperature over areas of U.S.S.R. is discussed. A study was conducted for the processes giving rise to extreme temperatures in February over the regions in question and the possibility of forecasting the synoptic processes for that month. Author

N71-34576 National Lending Library for Science and Technology, Boston Spa (England).
STATISTICAL ANALYSIS OF CHARTS OF HYDROMETEOROLOGICAL ELEMENTS
V. N. Moreckij 2 Mar. 1971 12 p refs Tran. into ENGLISH from Tr. Arkticheskogo i Antarkt. Nauchno-Issled. Inst. (Leningrad), no. 285, 1968 p 196-207
(NLL-M-20357-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Some methods of statistical analysis of two-dimensional fields of hydrometeorological elements are examined in relation to the variability of fields and their similarities and differences. Several examples are given of the statistical analysis of fields in terms of their numerical parameters. These examples show that it is possible to analyze hydrometeorological fields by means of correlation comparison of a series of element values read off from the fields to be analyzed at the grid points of equiareal regular grids. Author

N71-34577 National Lending Library for Science and Technology, Boston Spa (England).
THE PRINCIPLES OF THE CONSTRUCTION OF A PROGRAM FOR PICKING SYNOPTIC TELEGRAMS OUT OF THE GENERAL FLOW OF METEOROLOGICAL DATA
M. V. Kartasova et al 2 Mar. 1971 19 p refs Transl. into ENGLISH from Tr. Gidrometeorol. Nauk-Issled. Cent. SSSR (Leningrad), v. 1, 1967 p 10-21
(NLL-M-20358-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A program is described for finding synoptic telegrams in the general flow of meteorological information reaching the Main Radiometeorological Center over communication channels. Results of the program's work on actual material for several observation times are analyzed. Author

N71-34578 National Lending Library for Science and Technology, Boston Spa (England).
THE CONTRAST OF TEMPERATURE AND HUMIDITY BETWEEN THE MOUNTAIN STATIONS AND THE FREE ATMOSPHERE
S. Olejnik 2 Mar. 1971 11 p refs Transl. into ENGLISH from the Czech report
(NLL-M-20356-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The values of temperature and relative humidity obtained at various heights in the free atmosphere over Poprad for the years 1952 and 1956 are compared with those from the high mountain observatories on Lomnicky Peak at a height of 2635 m above sea level, and another meteorological station 857 m below it at Skalnaty Lake at a height of 1778 m above sea level. The results obtained are supplemented by a comparison of the free atmosphere with that from the ridge-sited station at Chopok, 48 km from Poprad, with a height of 1994 m above sea level. Only the years 1955 and 1956, when proper routine observation began, are included in the comparison for this station. The results indicate that between the mountain stations and the free atmosphere at the same height, a definite difference is present in the meteorological parameters. D.L.G.

N71-34579 National Lending Library for Science and Technology, Boston Spa (England).
ON THE DETERMINATION OF ANALOGUES OF FIELDS OF METEOROLOGICAL ELEMENTS
M. S. Cemuhin [1971] 10 p
(NLL-M-20696-(5828.4F)) Avail: Natl. Lending Library, Boston, Spa, Engl.: 1 NLL photocopy coupon

Two algorithms, in which the problem of classification without assistance is examined, are described for determining the analogs. The extremum analog is fairly simple, and has

several advantages, but the actual degree of analogy cannot alway be found. The optimal cycle algorithm eliminates this problem, but its solution is difficult because of the large number of possible variants. N.E.N.

N71-34580 National Lending Library for Science and Technology, Boston Spa (England).
SURFACE INVERSIONS OF AIR TEMPERATURE IN DIFFERENT REGIONS OF THE USSR
L. G. Vasileva et al [1971] 17 p refs Transl. into ENGLISH from Tr. Glav. Geofiz. Obs. (Leningrad), no. 264, 1970 p 322
(NLL-M-20590-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The frequency of inversions in the lowest 2m layer of the air over the U.S.S.R. is investigated. The inversions were determined from the differences between soil temperature and air temperature at 2m in a meteorological screen. Inversion frequencies were calculated for different combinations of cloudness, wind speeds, and observations times for each month, and also for all days with 24 hour inversions from July 1959 to December 1965. For reliability purposes, a comparison was made of inversions of the 7 to 8 year period with the 18 to 19 year period, also for the 5 year period for the latter. Calculations show little differences between the frequencies calculated during these times. Calculations also show the number of inversions decrease all over the U.S.S.R. during winter months. E.H.W.

N71-34581 National Lending Library for Science and Technology, Boston Spa (England).
ON THE POSSIBILITY OF USING THE STATISTICAL STRUCTURE OF METEOROLOGICAL FIELDS IN POLYNOMIAL OBJECTIVE ANALYSIS
I. I. Poliak [1971] 10 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 267, 1970 p 79-85
(NLL-M-20595-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A general least squares technique using a correlation matrix of measurements is outlined for polynomial objective analysis of meteorological fields. Numerical results are presented based on meteorological data from Europe. J.M.

N71-34582 National Lending Library for Science and Technology, Boston Spa (England).
METHOD FOR CALCULATING MEAN WIND SPEEDS DURING PRECIPITATION
E. G. Bogdanova 2 Mar. 1971 11 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 244, 1969 p 48-55
(NLL-M-20354-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The relation between wind speed during precipitation and wind speed obtained by averaging wind measurements made at equally spaced intervals is discussed. Charts of differences between the 5 year mean monthly wind speed at observation times when precipitation was falling and all wind measurements averaged over the same period are presented. The charts represent qualitative rather than quantitative variations occurring over the Russian territory in question. Author

N71-34583 National Lending Library for Science and Technology, Boston Spa (England).
INTERRELATION OF MIGRATIONS OF SUBTROPICAL ANTICYCLONES AND THE INTERTROPICAL CONVERGENCE ZONE
T. S. Kruzkova et al [1971] 14 p refs Transl. into ENGLISH from Gidromet. Nauk. -Issled. Cent. USSR (Leningrad), v. 41, 1969 p 3-12
(NLL-M-20650-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The monthly mean positions of the subtropical anticyclones and ITC were determined by adding up their frequencies in 5 deg squares for the central months of the seasons in 1966 and 1967. Synoptic charts, contour charts of the tropical zone, and cloud charts based on satellite data were used to draw charts of the mean position during January, April, July and October. Using these charts, the areas of the ITC and subtropical anticyclones were drawn through the zones of maximum frequency. The mean positions of two main factors in the circulation of the tropical atmosphere clearly show coordinated oscillations in east to west and north to south directions. It was noted that even in the smoothed annual variation there are marked oscillations of the zones of subtropical highs in the northern and southern hemispheres in a north to south direction. Changes in the position of the axis of the subtropical highs were noted to occur simultaneously in the northern and southern heimispheres in most cases, being distinguished by coordinated northward or southward deviations of the main position of the axis. Author

N71-34584 RAND Corp., Santa Monica, Calif.
METEOROLOGICAL ASPECTS OF MIDDLE EAST WATER SUPPLY
R. E. Huschke Mar. 1970 51 p refs
(RM-6267-FF) Copyright. Avail: Issuing Activity

The flux of atmospheric water, the frequencies and paths of storms, and the local water budget are related to provide a general description of the hydroclimate of the Middle East. The potential for rain stimulation in various areas is discussed and an estimate made of the potential value of a rain-stimulation project over the west slopes of the Judean Hills. It is concluded that any other rain-stimulation projects must await hydrologic development of the large river systems. Author (NSA)

N71-34585 Freie Univ., Berlin (West Germany).
METEOROLOGICAL DATA. VOLUME 98, NO. 2: WEATHER SATELLITE OBSERVATIONS AND THEIR EVALUATION. THE EUROPEAN CLIMATOLOGY 1966, PART 2 [METEOROLOGISCHE ABHANDLUNGEN. BAND 98, HEFT 2: WETTERSATELLITENBEOBACHTUNGEN UND IHRE AUSWERTUNG DAS EUROPAEISCHE WETTERBILD 1966, TEIL 2]
Ingrid Haupt, Ute Katergiannakis et al 1970 238 p refs In GERMAN
Avail: Issuing Activity

A short review of the space research outside of the USSR and the USA is given, and some remarks are made about the false start of Nimbus 3. The new Soviet weather satellite Cosmos 226 is mentioned, and the snow and ice conditions in the European area are discussed for the period April through June 1966. The daily ESSA 6/APT photographs for April through June are presented, and orbital data for ESSA 6 and special data for the APT pictures taken in Berlin are included. Author

N71-34999# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astron., and Space, No. 257 30 Jul. 1971 p 3-15 refs (See N71-34997 21-30)
Avail: NTIS

N71-35006# Joint Publications Research Service, Washington, D.C.
METEOROLOGY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, no. 258 13 Aug. 1971 p 3-13 refs (See N71-35004 21-30)
Avail: NTIS

21 NAVIGATION

Includes guidance; autopilots; stay and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-34586*# General Electric Co., Schenectady, N.Y. Corporate Research and Development
ATS RANGING AND POSITION FIXING EXPERIMENTS
Periodic Progress Report, 19 Mar. - 31 May 1971
31 May 1971 20 p
(Contract NAS5-11634)
(NASA-CR-121622) Avail: NTIS CSCL 17G

An adaptation of the tone-code ranging system to the L band frequency available on the ATS 5 is discussed. Present equipment will be modified and some designed and constructed to provide simultaneous, correlated range measurements. The precisely timed transmissions will enable a direct comparison of VHF path anomalies versus the L band path link. Periodic position fixes were made and reflect combined effects of both frequencies. Power budget analyses were also made and reflect marginal though unusable signals. The VHF portion of the proposed dual frequency system was field tested and results indicate no problems. Author

N71-34587*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATTITUDE STABILITY OF DISSIPATIVE DUAL-SPIN SPACECRAFTS
Arun K. Guha (NRC-NAS) Aug. 1971 25 p refs Submitted for publication
(NASA-TM-X-65681; X-730-71-326) Avail: NTIS CSCL 17G

The spin-axis attitude stability of dissipative dual-spin spacecrafts in force-free environment is examined. A mathematical model of a representative dual-spin system with energy dissipation on both bodies is proposed and the dynamical equations of motion are derived. The linear variational equations describing the behavior of the perturbed system in a neighborhood of an assumed equilibrium solution are shown to have periodic coefficients. A suitable similarity transformation is introduced which reduces (in the sense of Liapunov) the time-varying system to an autonomous one. This allows all the powerful techniques of time-invariant linear system theory to be applied to the dual-spin system. The theory is applied on a recently developed mathematical model of the SAS-A spacecraft and it is demonstrated that this spacecraft may be analyzed more precisely by utilizing this transformation than what has so far been achieved. Author

N71-34588*# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
ANALYSIS OF A NAVIGATION CONCEPT EMPLOYING A SPINNING RADIATING INTERFEROMETER IN GEOSTATIONARY ORBIT Interim Report
George Ranjan Thomas Aug. 1971 201 p refs
(Grant NGL-39-010-087)
(NASA-CR-121756; Rept-72-05) Avail: NTIS CSCL 17G

Navigation satellite systems have been proposed as aids to long-distance navigation, particularly over large ocean areas. Desirable attributes of such a system include unsaturability, which would require that the users be passive (nontransmitting), and maximum coverage area, requiring a synchronous (24-hour) satellite. A single satellite suitable for passive users necessitates interferometric (angle-measuring) methods, and systems consisting of nonspinning synchronous satellites carrying crossed interferometer pairs have already been investigated. Since conventional spin-stabilization is employed by the majority of existing satellites, it is desired to apply interferometric techniques to spinning satellites. Author

N71-34589*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ATTITUDE SENSOR Patent Application
Arthur C. Davidson, inventor (to NASA) and McLean M. Grant, inventor (to NASA) Filed 2 Feb. 1971 40 p
(NASA-Case-GSC-10890-1; US-Patent-Appl-SN-111998) Avail: NTIS CSCL 17G

A system is described for sensing the attitude of a spacecraft which includes a pair of optical scanners having a relatively narrow field of view rotating about the spacecraft x-y plane. The spacecraft rotates about its z axis at a relatively high angular velocity while one scanner rotates at low velocity, whereby a panoramic sweep of the entire celestial sphere is derived from the scanner. In the alternative, the scanner rotates at a relatively high angular velocity about the x-y plane while the spacecraft rotates at an extremely low rate or at zero angular velocity relative to its z axis to provide a rotating horizon scan. The positions of the scanners about the x-y plane are read out to assist in a determination of attitude. While the satellite is spinning at a relatively high angular velocity, the angular positions of the bodies detected by the scanners are determined relative to the sun by providing a sun detector having a field of view different from the scanners. NASA

N71-34590*# National Aeronautics and Space Administration, Washington, D.C.
PASSIVE GRAVITY-GRADIENT LIBRATION DAMPERS: SPACE VEHICLE DESIGN CRITERIA (GUIDANCE AND CONTROL)
Feb. 1971 60 p refs
(NASA-SP-8071) Avail: NTIS CSCL 17G

Existing successful design techniques and practices for passive GGL dampers are assessed. A state-of-the-art review is given which encompasses both design experience and flight experience. Design criteria and recommended practices are presented in separate sections that include treatment of: thermal design, magnetic design, radiation protection, space vacuum, weightlessness, spacecraft integration, launch environment, and performance verification. D.L.G.

N71-34591*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DUAL PURPOSE MOMENTUM WHEELS FOR SPACECRAFT Patent Application
Narsingh Deo, inventor (to NASA) Filed 16 Apr. 1971 10 p
(NASA-Case-NPO-11481; US-Patent-Appl-SN-134571) Avail: NTIS CSCL 17G

A dual purpose momentum wheel apparatus is described in which a conventional momentum wheel, normally utilized for altitude stabilization of spacecraft, was modified to function as a memory system for the storage of scientific data. The momentum wheel apparatus is comprised of a rotary motor mounted within a hermetically sealed drum. A momentum wheel is mounted on the motor and is adapted to rotate adjacent the interior surface of the drum. The outer periphery of the momentum wheel is coated with a magnetic material, while a plurality of read-write heads are adjustably mounted on the interior of the drum in close proximity to the magnetic periphery of the momentum wheel. NASA

N71-34592# Federal Aviation Administration, Washington, D.C. Flight Information Div.
IFR OFF-AIRWAY NON-95 ROUTES
May 1971 24 p
Avail: NTIS

A compilation of commercial and military instrument flying rules off-airway routes in the United States, Alaska, Puerto Rico, and Pacific Areas is presented. Each entry contains information required for safe instrument flight along the air route. P.N.F.

N71-34593*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
FIXED-ANGLE TRANSLUNAR GUIDANCE PROCEDURES

USING ONBOARD OPTICAL MEASUREMENTS
Harold A. Hamer and Katherine G. Johnson Washington Sep. 1971 41 p refs
(NASA-TN-D-6461; L-7811) Avail: NTIS CSCL 17G

Onboard procedures requiring only simple calculations were developed for midcourse and approach guidance for translunar trajectories. For midcourse guidance the procedure relies solely on an optical range measurement. The approach-guidance procedure requires a star-to-body measurement and may require a range measurement, depending on the distance to the moon. For both procedures the velocity-correction vector is applied in a fixed inertial direction. In the approach-guidance procedure either one or two guidance maneuvers are applied, depending on the accuracy desired and the distance to the moon. An error analysis showed that perilune radius can be controlled to a one-sigma accuracy of about 30 km. Author

N71-34594*# Federal Aviation Administration, Washington, D.C.
CENTRALIZED FLOW CONTROL
Robert W. Martin May 1970 15 p Presented at the 1970 Ann. Conf. of the Natl. Federation of the Air Traffic Controllers Assoc., 11-14 May 1970
Avail: NTIS

A concept called centralized flow control is described. The evolution of the Central Flow Control Facility operated by the FAA at Washington, D.C. is outlined and possibilities for future application of the principle of central flow control are discussed. Author

N71-34129*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN EXAMINATION OF THE EFFECTS OF STATION LONGITUDE ERRORS ON DOPPLER PLUS RANGE AND DOPPLER ONLY ORBIT DETERMINATION SOLUTIONS WITH AN EMPHASIS ON A VIKING MISSION TRAJECTORY
V. J. Ondrasik and N. A. Mottinger *In its* The Deep Space Network, Vol. 4 15 Aug. 1971 p 71-77 refs (See N71-34118 21-07)
Avail: NTIS CSCL 17G

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-34595# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.
SELFWELDING OF REACTOR STRUCTURAL MATERIALS IN SODIUM ENVIRONMENT AT HIGH TEMPERATURES [SELBSTVERSCHWEISSEN VON REAKTORSTRUKTURWERKSTOFFEN UNTER NATRIUM BEI HOHEN TEMPERATURES]
K. Benndorf Apr. 1970 21 p refs In GERMAN; ENGLISH summary
(KFK-Ext.Ber.-8/70-1) Avail: AEC Depository Libraries

With the purpose of investigating the self-welding tendency of structural materials in the light of the sodium-cooled fast breeder reactor to be built, static load tests in sodium were carried out on these materials. Besides austenitic materials, a stabilized ferritic steel and a nickel-base alloy, as well as several hard facing and hard metal alloys, were used in the tests. The test temperatures were 580 and 700C; the compressive load ranged up to 5 kp/sq mm2; and the tests lasted for 168 hrs. The results showed a more or less pronounced tendency of all the materials to weld together. Solely the nickel-base alloy did not weld together, with one exception. Author (NSA)

N71-34596*# Idaho Nuclear Corp., Idaho Falls.
CAVITY REACTOR CRITICAL EXPERIMENT, VOLUME 4 (WAVES AND CONTROL METHODS)
G. D. Pincock and J. F. Kunze Oct. 1969 256 p refs
(NASA Order C-67747A; Contract AT(10-1)-1230)
(NASA-CR-72550; IN-1336) Avail: NTIS CSCL 18I

Experiments are reported which evaluate the effects of fuel wave formations on the outer boundary of the active core as a function of wave size and axial position. The effects of rounding off the core at the ends are included, and the reactor control methods such as a poison sleeve and the rotating runs are also evaluated. Author

N71-34597*# Idaho Nuclear Corp., Idaho Falls.
CAVITY REACTOR CRITICAL EXPERIMENT, VOLUME 5 (COMPLETE CO-AXIAL FLOW MOCKUP)
G. D. Pincock and P. L. Chase Nov. 1969 107 p refs
(NASA-Order C-67747A; Contract AT(10-1)-1230)
(NASA-CR-72577; IN-1340) Avail: NTIS CSCL 18I

A detailed mockup of the coaxial flowing gas cavity reactor was performed with the critical experiment assembly. The hydrogen coolant was simulated with polystyrene and polyethylene and thin solid sheets of uranium were used to mockup the gaseous fuel. The fuel and hydrogen varied both radially and axially to mockup the calculated distribution of these materials in a hot, operating system. The cavity wall was lined with stainless steel, 0.04 meanfree absorption paths thick, to simulate the cavity containment vessel and there was a annulus of fuel containing 823 grams of U-235 in the radial reflector. Author

N71-34598*# Idaho Nuclear Corp., Idaho Falls.
SPHERICAL GAS CORE REACTOR CRITICAL EXPERIMENT
J. H. Lofthouse and J. F. Kunze Feb. 1971 80 p refs Prepared for AEC, Idaho Falls, Idaho
(NASA Order C-67747A; Contract AT(10-1)-1230)
(NASA-CR-72781; IN-1443) Avail: NTIS CSCL 18I

Criticality experiments using gaseous fuel are reported on. The experiments were relatively clean and should serve as benchmarks for calculational purposes. The inner spherical gaseous fuel region (127 cm dia) was located in a 183 cm diameter cavity surrounded by 91 cm of commercial grade heavy water. The critical mass was 8.4 kg of uranium in gaseous UF6 form. The second configuration had hydrogen added between the fuel and the cavity wall. The third added structural material to the cavity wall. The critical mass increased to 12.86 kg and kg of uranium, respectively. Four methods of controlling reactivity were examined. Results were favorable, with total control system worths as high as 18 dollars. Author

N71-34599*# Idaho Nuclear Corp., Idaho Falls.
CRITICAL EXPERIMENTS ON A MODULAR CAVITY REACTOR
J. F. Kunze and P. L. Chase May 1970 236 p refs Prepared for AEC, Idaho Falls, Idaho
(NASA Order C-67747A; Contract AT(10-1)-1230)
(NASA-CR-72681; IN-1376) Avail: NTIS CSCL 18I

Critical experiments were conducted which established reasonably simple geometric models that could be used as standards for design calculations for the modular cavity reactor. Reactors containing three modules and seven modules in a core volume of 183 cm (6 ft) diameter by 122 cm (4 ft) length were constructed. Each of these systems had a 89 cm (3 ft) reflector. Both moderator and reflector were heavy water, with 0.25% H20 impurity. All fuel was highly enriched uranium (93.2% U-235). The modules consisted of a central cylindrical fuel region within a cavity containing simulated hydrogen. For the seven module core the fuel to cavity radius ratio was varied from 0.38 to 0.72. For the three module core only a radius ratio of 0.55 was studied. Hydrogen coolant, simulated by low density polystyrene, surrounded the fuel on four of the configurations. One configuration was examined without any hydrogen in its cavities. Author

N71-34600*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
HEAT TRANSFER OPTIMIZATION AND REACTIVITY OF NUCLEAR ROCKET REACTORS
Terry Regg Simpson (Ph.D. Thesis) and Edward A. Mason Sep. 1970 246 p refs
(Grant NGL-22-009-019)
(NASA-CR-121735; CSR-T-70-3) Avail: NTIS CSCL 18I

A method of optimizing the axial power profile of a solid-core nuclear rocket reactor was developed. It is shown that the power profile is very dependent upon the heat transfer correlation used to predict channel wall temperatures, especially in the reactor core inlet region. It is demonstrated that the optimum reactor core dimensions and lap are insensitive to the form of the heat transfer correlation used. Reactivity characteristics for such compact, high performance reactor cores were calculated. It is shown that the hydrogen in the reflector can contribute several times more reactivity worth than the hydrogen in the reactor core. The critical uranium concentration, total and specific hydorgen reactivity worths, and mean fissioning energy are all shown to be strongly correlated to the geometrical buckling. Several equations are derived relating hydrogen worth to geometrical buckling. The total reactivity worth of hydrogen in the reflector is shown to be linearly proportional to the average hydrogen concentration in the reflector. Power tilting and loss of reactivity by core thermal expansion and corrosion loss of carbon are calculated. Author

N71-34601# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
FUEL MICROSTRUCTURE VARIATION AS A CONSEQUENCE OF THE FIRST IRRADIATION PERIODS AND APPROACH-TO-POWER
A. Calza Bini, E. Ferrante, A. Nobili, P. L. Rotoloni, and G. Testa 2 Oct. 1970 38 p refs Presented at the Italian-Polish meeting, Warsaw, 26 May 1970
(RT/ING-(70)20; Conf-700556-2) Avail: AEC Depository Libraries

The microstructure variations of fuel material during the first minutes in the reactor was investigated. A phenomenological model of fuel behavior during the first start-up which seems to influence the fuel life in the reactor was derived from the results.
Author (NSA)

N71-34602# United Kingdom Atomic Energy Authority, Harwell (England).
CALCULATION OF GRAPHITE CORROSION RATE. 2 USERS GUIDE TO A MODIFIED FORM OF THE RICHTER 2 PROGRAM IN SLAB AND SPHERICAL GEOMETRIES
W. S. Kyte Jan. 1971 15 p
(AERE-M-2403) Avail: AEC Depository Libraries

A description is given of the preparation of input data for the computer program RICHTER IISCS. This program uses a numerical integration method to calculate concentration and burn-off profiles in a section of graphite being corroded by water. The section may have slab, cylindrical or spherical geometry.
Author (NSA)

N71-34603# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
THERMAL DECOMPOSITION OF U3O8 POWDERS
S. Ferari, L. Giaquinto, L. Macioce, and C. Majani 2 Oct. 1970 20 p refs Presented at the Italian-Polish meeting, Warsaw, Poland, 26 May - 6 Jun. 1970
(RT/ING-(70)19; CONF-700556-3) Avail: AEC Depository Libraries

The sintering behavior in nitrogen atmosphere of U3O8 powder compacts is reported. On the basis of the shrinkage data of these compacts and the thermogravimetric behavior during decomposition of U3O8 powders a first approach to the possible phenomenological mechanism of sintering of these powders is proposed. This approach takes into account the influence of an organic substance on the decomposition of the U3O8 powder when heated at high temperature in nitrogen atmosphere.
Author (NSA)

N71-34604# Atomic Energy Commission Research Establishment, Riso (Denmark).
REVIEW OF DANISH IRRADIATION EXPERIMENTS IN THE HALDEN BOILING WATER REACTOR
Per Knudsen Feb. 1971 32 p refs
(RISO-M-1350) Avail: AEC Depository Libraries

Ten Danish UO2-Zr fuel assemblies have been manufactured for in-pile performance testing and evaluation of design parameters in the Halden Reactor in Norway. The eight assemblies irradiated so far have shown a generally good performance with a maximum average assembly burnup of 13,500 MWd/t UO2 (corresponding to 16,800 MWd/t UO2 peak pellet). One fuel pin out of a total of 88 has failed, probably as a result of internal attack of fission product iodine. Pellet stacks in one assembly decreased in volume during irradiation; this is explained as a result of fuel-clad mechanical interaction leading to compressive creep of the UO2. Five helical plenum springs of Inconel X-750 in the fuel pins of one assembly were fractured, because heat treatment after spring manufacture was inadvertently omitted.
Author (NSA)

N71-34605# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
VENTING DEVICE FOR SODIUM COOLED FAST CERAMIC REACTOR FUEL ELEMENTS: DESIGN STUDY AND OUT OF PILE TESTS
G. Bertoncello, A. Gerosa, and M. Martini 20 Nov. 1970 62 p refs Presented at Intern. Conf. on the Constructive Uses of Atomic Energy, Washington, D.C.
(RT/ING-(70)29; RVT-SEC-(70)36; Conf-681101-47) Avail: AEC Depository Libraries

In the framework of the Italian Fast Reactor Program (P.R.V.) a study of hydraulic type venting devices was made. Preliminary out of pile tests verified that the double capillary venting device chosen presents good performance under stationary and transient conditions.
Author (NSA)

N71-34606# Commissariat a l'Energie Atomique, Saclay (France). Department des Etudes de Piles.
EL-600: NEUTRONIC STUDY OF CORE CONTROL SYSTEMS
Marcel Chabrillac, Stephen Goldstein, Bernard Micaux, Roger Naudet, and Tran Tuc Vi Feb. 1971 68 p refs In FRENCH
(CEA-N-1421) Avail: AEC Depository Libraries

The EL-600 is the design of a 600 MW(e), heavy water moderated and cooled reactor of the Canadian type. The control was studied by seperating the various functions and their related devices: overall control rods, zone control rods, adjuster rods, and safety rods. The efficiency of various control mechanisms, such as rods and moderator poisoning, was defined after studies of operating conditions have dealt with normal or accidental transients.
Author (NSA)

N71-34607# European Atomic Energy Community, Ispra (Italy).
XBWR: A ONE DIMENSIONAL XENON TRANSIENT PROGRAMME FOR BOILING NUCLEAR REACTORS
G. Forti 14 Oct. 1970 46 p
(EUR-4603-e) Avail: AEC Depository Libraries

XBWR is a FORTRAN program for the analysis of xenon transients in axial geometry. It couples a two group neutron diffusion calculation in plane geometry with a two phase flow cooling channel calculation and the heat conduction in the typical fuel rod. The program allows any given power time schedule to be followed, such as shut-down and restart, day-night power variation, while the reactor is being kept critical by control rod movement, variable poisoning of the core, or coolant flow recirculation rate. The xenon and iodine concentrations variations are evaluated pointwise (up to 100

points) by analytical solution for successive fixed time steps. At the end of each time step a new distribution of fluxes, power, voids and temperatures is obtained, which is consistent with the reactor critical condition as it is obtained by variation of the control parameter taking into account the feedbacks. The new flux distribution is used as input for xenon and iodine concentrations evolution in the next time step. Author (NSA)

N71-34608# Production Group, United Kingdom Atomic Energy Authority, Sellafield (England).
FURTHER EXPERIMENTS ON THE THERMAL BOWING OF SINGLE RODS SUPPORTED AT SEVERAL AXIAL POSITIONS
A. C. Rapier and T. M. Jones 19 Oct. 1970 22 p refs
(TRG-2089) Avail: AEC Depository Libraries

Two types of experiments were carried out on elements with three different heat transfer surfaces: smooth, ribs transverse to the coolant flow, and ribs with a helix angle of 47 deg. In the first experiment, changes in surface temperature were measured when the elements were displaced parallel to the channel axis. In the second experiment, the development of bow was observed as the temperature difference between the surface and the coolant was increased. Values of the non-dimensional differential coefficient of heat transfer were derived independently from the two types of experiments and found to be in good agreement. The smooth surface, under the conditions tested, was found to be less unstable than previously predicted and measured, the transverse ribbed surface was just about as unstable as previously determined and the helical ribbed surface was inherently stable. Author (NSA)

N71-34609# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
EVALUATION OF PROBLEMS RELATIVE TO A FLOW-SHEET FOR THE REPROCESSING OF FUTURE POWER REACTOR FUEL
M. Abita, A. Barocas, G. Beone, and A. Moccia 13 Jan. 1971 35 p refs In ITALIAN
(RT/CHI-(71)3) Avail: AEC Depository Libraries

The lay-out of a flowsheet for reprocessing spent fuels from Italian power reactors beginning in 1980 is considered. The research and development topics to be investigated are identified. Author (NSA)

N71-34610# Aktiebolaget Atomenergi, Studsvik (Sweden).
STUDY OF THE RING TEST FOR DETERMINATION OF TRANSVERSE DUCTILITY OF FUEL ELEMENT CANNING
G. Anevi and G. Oestberg 1971 17 p refs
(AE-412) Avail: AEC Depository Libraries

A ring test is studied for determination of transverse ductility of fuel element canning. The theoretical aspects of the deformation in the transverse ductility test are discussed as well as practical problems in its performance. Particular emphasis is given to the influence on ductility of the length of the specimen and the friction between specimen and plug. Applications in post-irradiation examination are described. Author (NASA)

N71-34611# Israel Atomic Energy Commission, Tel Aviv.
SHOVAV: PROGRAM TO SOLVE THE FEW-GROUP SPACE-TIME DEPENDENT DIFFUSION EQUATION WITH TEMPERATURE FEEDBACK
D. Saphier and S. Yiftah Jan. 1971 134 p refs
(IA-1217) Avail: AEC Depository Libraries

The diffusion equation is solved for a slab reactor with a maximum of eleven regions, one hundred mesh points, four energy groups, and six delayed neutron groups. Ten isotopes may be present in the mixture. The mean fuel and coolant temperatures at each mesh point are calculated, and their influence on the coolant density and the various cross sections is taken into account via the cross section mixing and shielding factors. Author (NSA)

N71-34612# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.
COSTAX-BOIL: A COMPUTER PROGRAMME OF COSTANZA SERIES FOR THE AXIAL DYNAMICS OF BWR AND PWR NUCLEAR REACTORS
G. Forti 1970 58 p refs
(EUR-4497e; EUR-FF-9.45) Avail: AEC Depository Libraries

COSTAX-BOIL is a FORTRAN program for transient analysis of BWR in the time domain. It couples the two velocity groups neutron diffusion kinetic calculations (up to 10 delayed neutron groups) in one dimension (axial) with the heat conduction equations in the fuel rods and a two phase flow dynamics calculation for the typical coolant channel. Doppler and void reactivity feedback are accounted for pointwise. A flexible input allows representation of reactivity transients, flow recirculation or inlet enthalpy transients, or an arbitrary mixture of them, including control rod bank movement. No pressure variation is possible in the present version. The program is intended for the analysis of intermediate accidents or severe operational transients in which a detailed spatial representation is essential. Author (NSA)

N71-34613# Atomic Energy Commission Research Establishment, Riso (Denmark).
ELECTRONICS DEPARTMENT Semiannual Report, 1 Apr. - 30 Sep. 1969
Feb. 1970 24 p refs
(RISO-M-1206) Avail: AEC Depository Libraries

Development of the computer-controlled instrumentation for the DR 2 reactor is described. Participation in the uranium prospecting program in Greenland is outlined, and field measurements of zirconium and niobium by x-ray fluorescence analysis are described. Also, the development of the data handling system for the isotope laboratory, development of the reactor alarm-event recording system, and development of the difference analyzer using a waveform eductor for plasma physics experiments are summarized. NSA

N71-34614# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
EXPERIMENTAL VIBRATION CHARACTERISTICS OF A BWR FUEL ASSEMBLY
N. Ferrucci and D. Pitimada 21 Oct. 1970 43 p refs Presented at Am. Nucl. Soc. Meeting, Los Angeles, 29 Jun. 1970
(RT/ING-(70)24; Conf-700608-35) Avail: AEC Depository Libraries

The bending modes of single rods assembled in a B. W. R. fuel assembly are determined testing a model in air. The measured resonances are compared against the modes of the end restrained rod without intermediate spacers. End fixity values of single rods are determined using both static and dynamic methods. Author (NSA)

N71-34615# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna. Reaktorzentrum Seibersdorf.
DETERMINATION OF THE DISTRIBUTION OF FISSION PRODUCTS IN FUEL PARTICLE COATINGS BY THE SPUTTERING TECHNIQUES
G. Betz, R. Pobrozemsky, F. P. Viehboeck, and H. Wotke May 1970 15 p refs Submitted for publication
(SGAE-PH-96/1970) Avail: AEC Depository Libraries

For the retainment of fission products, high-temperature fuel particles normally are coated with pyrolytic carbon and silicon carbide layers. The knowledge of the distribution of the fission products in these coatings for a given history of irradiation is very important for the prediction of the lifetime of fuel particles and for the improvement of the retainment factor. Due to their chemical resistivity and porous structure, the peeling off of the coating layers by chemical or mechanical methods is very difficult and only rough steps of peeling off have been achieved up to now. A new method is investigated: peeling off by sputtering, using an A(+) ion beam of 40 keV energy. The

sputtered material is condensed on collecting foils and the fission products are determined by Ge(Li)-gamma-spectrometry. The method and the experimental set-up are described and first results on the fission product distribution in PyC and PyC-SiC-PyC coatings are given. Author (NSA)

N71-34616# Battelle Memorial Inst., Columbus, Ohio.
THERMAL DIFFUSIVITY MEASUREMENTS OF IRRADIATED OXIDE FUELS (LWBR DEVELOPMENT PROGRAM)
J. Matolich, Jr. and V. W. Storhok 6 Feb. 1970 52 p refs
(Contract AT(11-1)-gen-14)
(BMI-X-10274) Avail: NTIS

The effects of irradiation on the thermal conductivity of ThO2-UO2 fuels were investigated. It appears that irradiation at a temperature of about 725 C resulted in damage to the lattice that was manifested by a relatively large decrease in thermal diffusivity and thermal conductivity. However, these data are considered to be inconclusive because of the possibility that the presence of large, nonuniformly distributed pores in the specimens influenced the measurements in an unpredictable manner. Irradiation at a temperature of 980 C had no significant effect on thermal conductivity. Apparently any radiation damage to the lattice was annealed out at this temperature in-pile. Author (NSA)

N71-34617# Idaho Nuclear Corp., Idaho Falls.
EFFECTS OF STATE PROPERTIES ON HIGH PRESSURE COMPRESSIBLE HYDRODYNAMICS
K. V. Moore and G. E. Gruen [1970] 10 p refs Presented at Meeting on New Develop. in Reactor Mathematics and Appl., Idaho Falls, Idaho, 29 Mar. 1971 Sponsored by AEC
(Conf-710302-6) Avail: NTIS

The ASME equations of state for water were incorporated into RELAP3 as a trial version called RELAP3/ASME. In comparisons to experimental data, this trial version gives substantial improvement over RELAP3 in predicting subcooled blowdown pressure histories. The standard version of RELAP3 is a computer code for analyzing reactor core and loop thermal hydraulics during blowdown. The failure of RELAP3 to correctly predict subcooled pressure histories was traced to inaccurate sonic velocities. Water properties are built-in as tables of pressure versus enthalpy and density. These tables and any dependence on interpolation schemes were eliminated in RELAP3/ASME by incorporating the 1967 ASME equations of state. Each equation, which is defined for particular ranges of pressure and temperature, uses either pressure and temperature or specific volume and temperature as independent variables. Within RELAP3/ASME, a two-dimensional Taylor series expansion is performed on the ASME equations which transforms the independent variables to specific internal energy and specific volume. Author (NSA)

N71-34618# Oak Ridge National Lab., Tenn.
VISCOELASTIC ANALYSIS OF IRRADIATED GRAPHITE WITH VARIABLE CREEP COEFFICIENT
S. J. Chang, J. A. Carpenter, and D. W. Altom May 1971 33 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3242) Avail: NTIS

Stress analysis for irradiated graphite used for molten salt breeder reactor core design is presented. To provide a refined analysis, the method includes the effect of a variable creep coefficient which is caused by the nonuniform temperature distribution. To facilitate a simple formulation, it is assumed that the temperature dependence of the elastic response of the material is approximated to be inversely proportional to the creep rate. It is shown that the problem reduces to the solution of several associated (fictitious) elastic problems which have a common elastic modulus inversely proportional to the creep rate of the irradiated graphite. A computer program was written. Author (NSA)

N71-34619# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
STATIC AND DYNAMIC EXPERIMENTS WITH A REPETITIVELY PULSED BOOSTER
J. T. Mihalczo 22 Mar. 1971 56 p refs
(Contract W-7405-eng-26)
(Y-DR-44) Avail: NTIS

A series of dynamic measurements were performed with a multiplying assembly in which a rotating beryllium reflector (worth 4.8 dollars in reactivity) moved past an unreflected core surface approximately 60 times/sec at a speed of 264 meters/sec. A pulse of 14.1 MeV neutrons was injected into the assembly each time the rotating reflector attained a position for which the reactivity of the assembly was maximum. The time distribution of neutrons after injection of the pulse was measured. The maximum prompt neutron multiplication of the assembly, which was reflected with iron on all sides but one and contained 58.6 kg of uranium (enriched to 93.2 wt% in U-235 isotope) metal at delayed criticality, was varied by fuel loading changes from 75 to 285. The pulsed assembly, with a maximum prompt neutron multiplication of 285, produced neutron pulses having a width at half maximum of 3.9 microseconds and a peak-to-minimum ratio of 12,400. Author (NSA)

N71-34620# Kanner (Leo) Associates, Redwood City, Calif.
EXPERIMENTS ON WEAR AND FRICTION BETWEEN SUBASSEMBLIES AND GRID SPACERS IN SODIUM
K. Kleefeldt Mar. 1971 21 p Transl. into ENGLISH of West German report KFK-1290
(AEC-tr-7224; KFK-1290) Avail: NTIS

Results of experiments in sodium in which the friction between fuel element bundle and spacer grids was investigated up to temperatures of 680 C are described. The relative axial movement between the fuel pins and the spacers was simulated mechanically using an eccentric drive. The frictional forces produced during this process were 5 to 20 kg per spacer grid in sodium and higher in air and argon. For two different spacer designs a critical frictional force of approximately 55 kg and 60 to 80 kg, respectively, was determined. If the frictional force exceeds the critical value due to a lack of clearance, the bowing of the grid leads to a clamping effect and to plastic deformation. Repetitive movement of the bundle causes the spacer grid to rupture. The increase in clearance by wear is less than 0.02 mm. Diffusion welding of joints in sodium was not detectable after seven days of shutdown period at 600 C. Discussions are included on the advantages and drawbacks of the selected methods of spacer grid fastening. Author (NSA)

N71-34621*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SIMULATED ISOTOPE HEAT SOURCE FOR USE IN BRAYTON POWER SYSTEM
Robert B. Smith and George M. Prok Washington Sep. 1971 12 p refs
(NASA-TM-X-2374; E-6387) Avail: NTIS CSCL 18I

A simulated isotope heat source was designed and tested for use in the Brayton power system. The simulated isotope heat source enables ground testing of flight-like hardware without the inherent hazards of the isotope heat source. The simulated isotope heat source is electrically powered, and was operated for 820 hours at various power levels. The design objectives for the simulated isotope heat source were met. Power and temperature levels were well within a usable range and the life was demonstrated to be sufficient for preliminary testing of the isotope Brayton cycle. An array of electrically heated simulated isotope heat sources may be used to supply 25 kilowatts or more of thermal power to the Brayton system heat source heat exchanger. Author

N71-34622# Institute of Technology, Helsinki (Finland). Dept. of Technical Physics.
INFORMATION THEORETICAL ASPECTS OF POWER SPECTRUM MEASUREMENTS IN NUCLEAR REACTORS

Bruno Baers 20 Jan. 1970 47 p refs
(TKK-F-A-102) Avail: AEC Depository Libraries

The relative merits of one- and two-detector techniques in power spectrum measurements on nuclear reactors and the influence of various reactor and detector parameters on three different figures of merit were investigated. In the general case the auto-and cross-correlation techniques are complementary and the one cannot replace the other. In the first approximation with specific assumptions the information in a set of power spectrum estimates is determined by one single parameter, the equivalent number of degrees of freedom associated with the power spectrum estimates. Explicit expressions for the statistical uncertainty associated with auto- and crosspower spectra are given based on a space- and energy-independent reactor and detector model. The influence of gamma radiation and of the gamma compensation signal on the statistical accuracy is taken into account. Author (NSA)

N71-34623# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
ANALYTICAL METHODS USED IN EVALUATING NERVA FUEL ELEMENTS
F. E. Clark 22 Feb. 1971 13 p Presented at the 22nd Pittsburgh Conf. on Anal. Chem. and Appl. Spectry., Cleveland, 28 Feb. 1971
(Contract W-7405-eng-26)
(Y-DA-3934; Conf-710207-2) Avail: NTIS

To prevent failure of a fuel element, which could result in an aborted flight, elaborate inspection procedures on both raw materials and fuel elements are required. Nondestructive measurement techniques such as DXT gaging, electrical resistance, gamma count, X-ray, beta backscatter, eddy current application for the location of matrix flaws, and gas leak rates are among those used in the evaluation of fuel elements. NSA

N71-34624# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
SUMMARY OF (U,Pu)O2 PROPERTIES AND FABRICATION METHODS
B. F. Rubin, comp. Nov. 1970 78 p refs
(Contract AT(04-3)-189)
(GEAP-13582) Avail: NTIS

Properties and fabrication techniques intended to serve as a reference for those interested in ceramic oxide fuels for fast breeder reactor applications are compiled. The PuO2 content of such fuels is greater than or equal to 15 wt %, and these compounds are thereby distinguished from the mixed oxide fuels with lower PuO2 concentrations that are recycled in thermal reactors. Author (NSA)

N71-34625# Kansas State Univ., Manhattan. Dept. of Nuclear Engineering.
FAST NEUTRON TRANSMISSION MEASUREMENTS FOR REACTOR CORE AND SHIELDING MATERIALS Technical Progress Report, 1971
Walter Meyer Mar. 1971 66 p refs
(Contract AT(11-1)-2049)
(COO-2049-4) Avail: NTIS

Research to design and perform double differential fast neutron transmission experiments for semi-infinite slabs of several important reactor core construction and shielding materials including concrete, iron, water and laminated assemblies of these materials of precisely defined structure is described. These experiments are designed to generate fast neutron penetration data that are necessary to complete complex core shielding analyses as well as to test and evaluate fast neutron transport codes. Author (NSA)

N71-34626# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
JOSHUA TERMINAL SYSTEM
J. C. Jensen, R. L. Boyce, J. E. Suich, and R. C. Haywood 18 Mar. 1971 10 p refs
(Contract AT(07-2)-1)
(TID-25691) Avail: NTIS

The JOSHUA reactor physics computational system was designed to enable users to execute modules and to have access to an extensive data base with remote display terminals. The JOSHUA terminal system (JTS) was developed to provide the terminal facilities required for module execution and data base manipulation. The capabilities of the JTS are described, its implementation is discussed, and some experience with the system is presented. NSA

N71-34627# Oak Ridge National Lab., Tenn.
ORNL NUCLEAR SAFETY RESEARCH AND DEVELOPMENT PROGRAM Bimonthly Report, Jan. - Feb. 1971
Wm. B. Conttrell May 1971 127 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3342) Avail: NTIS

Much of this work is in general support of water-cooled power reactor technology, including LOFT and industry programs, and reflects current safety problems, such as measurements of prompt fuel element failure phenomena and the problems associated with the long-term operation of containment spray systems. Several projects are also conducted in support of the high-temperature gas-cooled reactor (HTGR) and liquid-metal fast breeder reactor (LMFBR) programs. Other major projects are those on primary piping and steel pressure-vessel technology. They also include experimental investigations of the attachment of nozzles to shells and the implementation of joint AEC-PVRC programs on heavy-section steel technology and nuclear piping, pumps, and valves. Of particular interest in these activities is the recent emphasis on environmental effects. Author (NSA)

N71-34628# Los Alamos Scientific Lab., N. Mex.
ANCON USER'S MANUAL
John C. Vigil May 1971 41 p refs
(Contract W-7405-eng-36)
(LA-4616) Avail: NTIS

The ANCON code is a FORTRAN-4 program that solves the point reactor kinetic equations, including thermal feedback. The lump-type heat balance equations are used to represent thermodynamics, and the heat capacity of each lump can vary with temperature. Thermal feedback can be either a linear or a nonlinear function of lump temperature, and the impressed reactivity can be either a polynomial or sinusoidal function. A description of the equations solved by the code, a description of the computational algorithms, detailed input specifications, and other information required for effective use of the code are presented. The code is structured in a form such that reactivity or heat balance options, other than those presently available, can be incorporated with a minimum of code modification. Author (NSA)

N71-34629# Scientific Translation Service, Ann Arbor, Mich.
PRELIMINARY STUDY ON CHOPPING COMPLETE FUEL ELEMENTS OF THE SNR-NA2 AT WAK
B. F. Roth et al [1971] 41 p refs Transl. into ENGLISH from the German report NP-18451 Prepared for Oak Ridge Natl. Lab.
(ORNL-tr-2414; NP-18451) Avail: NTIS

In building a chopper for bigger fast breeder fuel elements, it seems to be sensible to assemble and build a chopper with a prototype scissor for SNR Na2 fuel elements, although the main arguments for a multiple chopper such as bigger output, is not yet valid. The output for a prototype chopper for closed fuel cycles of SNR Na2 system was calculated as an example. This output depends on the fuel reprocessing and refabrication capacity. Author (NSA)

N71-34630# Sandia Corp., Albuquerque, N. Mex.
LASL DART MINITHRUSTER SAFETY EVALUATION TESTS
F. L. Baker, R. C. Cranfill, and J. I. Entrekin Feb. 1971 80 p

Sponsored by AEC
(SC-RR-710012) Avail: NTIS

Safety evaluation tests were performed on the LASL DART Minithruster to determine the behavior of this device in a number of short environments. The tests included overpressure, fragment impact, granite impact, air drop, and solid propellant fire. A description of each test and the results are presented. Author (NSA)

N71-34631# Argonne National Lab., Ill. Engineering and Tech. Div.
VIBRATIONS AND STABILITY OF A TUBE CONVEYING FLUID
S. S. Chen and G. S. Rosenberg Mar. 1971 49 p refs
(Contract W-31-109-eng-38)
(ANL-7762) Avail: NTIS

The free vibration, forced vibration, and parametric response of a simply supported tube conveying fluid are analyzed, and the effects of initial curvature and Coriolis force are included and evaluated. The equation of motion is formulated to incorporate initial curvature, damping, axial force, and unsteady flow. Galerkin's method is used to determine the free vibration by solving an algebraic characteristic equation; the forced vibration is reduced to a system of coupled ordinary differential equations. Excitation due to pulsating flow is also examined by means of Galerkin's method, which, in this case, yields a set of coupled Mathieu-Hill-type equations. The possibility of onset of a parametric behavior is demonstrated, and explicit formulas are obtained for the boundaries of the first two instability regions. Due to the presence of a Coriolis force, the system is characterized by a phase difference and mode coupling. The significance of the Coriolis force is discussed. Author (NSA)

N71-34632# Los Alamos Scientific Lab., N. Mex.
Pu 238 SPACE ELECTRIC POWER FUEL DEVELOPMENT PROGRAM Quarterly Status Report, 1 Jul. - 30 Sep. 1970
T. K. Keenan, F. W. Schonfeld, and J. A. Leary Mar. 1971 18 p
(Contract W-7405-eng-36)
(LA-4647) Avail: NTIS

Modification of the fuel form from the original concept is reported. The new fuel form is designated plutonia molybdenum cermet. A new fuel characterization program is required by the change. Information is included on aspects of processing such as feed material preparation, particulate material coating, hot pressing methods development, and machining. Results are included on fuel compatibility with capsule materials, radiation effects on fuels, and physical properties of fuels. NSA

N71-34633# Iowa State Univ. of Science and Technology, Ames.
EFFECT OF OXYGEN ON THE STABILITY OF URANIUM-CARBON COMPOUNDS
Gary George Witt (M.S. Thesis) Feb. 1971 89 p refs
(Contract W-7405-eng-82)
(IS-T-438) Avail: NTIS

Results of investigations into uranium oxycarbide type compounds are summarized. Combining the oxide and carbide to form an oxycarbide gives a compound having a fairly high thermal conductivity, intermediate resistance to oxidation and corrosion, a larger composition range, and economical preparation by vacuum reaction of uranium dioxide with carbon. The effect of oxygen on the stability of uranium-carbon compounds is discussed. Author (NSA)

N71-34634# General Electric Co., Sunnyvale, Calif. Breeder Reactor Development Operation.
INTEGRATED SAFEGUARDS EXPERIMENT Quarterly Report, Sep. - Nov. 1970
D. C. Wadekamper, comp. and L. T. Hagie, comp. Jan. 1971 28 p refs
(Contract AT(30-1)-68)
(GEAP-12114-4; BHO-68-4; QR-2) Avail: NTIS

The first Integrated Safeguards Experiment, ISE campaign 1, was completed and the second experiment, ISE campaign 2, was initiated. Material balance calculations for two historical campaigns were completed. The plutonia feed measurements for two historical campaigns as well as ISE campaigns 1 and 2 were reviewed and analyzed. Trial material balance and total oxide balance for ISE campaign 1 were completed. Available ISE campaigns 1 and 2 measurement and processing data applicable to material balance accounting are summarized. A brief explanation of the present mechanized accountability and criticality system is presented. Author (NSA)

N71-34636# Bettis Atomic Power Lab., Pittsburgh, Pa.
BUSHL: A COMPUTER PROGRAM FOR THE INELASTIC BUCKLING OF SHELLS OF REVOLUTION UNDER EXTERNAL PRESSURE AND AXIAL COMPRESSION (LWBR DEVELOPMENT PROGRAM)
A. L. Thurman Mar. 1971 114 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-890) Avail: NTIS

BUSHL is a computer program that can be used to determine the load at which finite length shells of revolution buckle when subjected to hydrostatic pressure, axial compression, or a combination of the two. Meridionally curved, double-layered discrete elements are used to obtain the solution. The program includes the effects of large prebuckling deformations and anisotropic inelastic material behavior. BUSHL was developed primarily for the buckling collapse analysis of Zircaloy-clad oxide fuel rods. Author (NSA)

N71-34638# Mechanical Technology, Inc., Latham, N.Y.
LIQUID METAL BEARINGS TECHNOLOGY FOR LARGE, HIGH TEMPERATURE SODIUM ROTATING MACHINERY Progress Report, 1 Aug. 1970 - 31 Jan. 1971
E. B. Arwas, R. Newell, T. Smalley, and W. D. Waldron 31 Jan. 1971 24 p refs
(Contract AT(30-1)-3930)
(NYO-3930-10; MTI-71-TR-11) Avail: NTIS

Activities are reported in a program to develop data and instrumentation needed for reliable design, optimization, and experimental evaluation of Na-lubricated bearings for high-capacity Na pumps and other auxiliaries of the circulation systems of breeder reactors. Information is included on development of design handbooks on self-acting bearings and externally pressurized bearings, and development of Na test bearing systems. NSA

N71-34637# Westinghouse Electric Corp., Madison, Pa. Advanced Reactors Div.
OXIDE FUEL ELEMENT DEVELOPMENT Quarterly Progress Report, period ending 30 Sep. 1970
A. Boltax Jan. 1971 142 p refs
(Contract AT(30-1)-4135)
(WARD-4135-13) Avail: NTIS

Activities in programs on analytical and experimental studies of mixed oxide fuel pins are summarized. Data and information are included on fuel performance analysis, development of fuel lifetime codes, mixed oxide fuel pin irradiation, grid-type fuel assembly design, development and testing of LMFBR fuel assemblies, development of EBR-2 grid-type subassemblies, pellet fabrication, oxide fuel characterization, fuel element fabrication, and product control. NSA

N71-34639# Los Alamos Scientific Lab., N. Mex.
SODIUM-BONDED (U,Pu)C FUEL ELEMENTS AFTER MODERATE BURNUP
J. O. Barner Apr. 1971 29 p refs
(Contract W-7405-eng-36)
(LA-4668) Avail: NTIS

Two sodium-bonded, single phase (U0.8Pu0.2)C fueled, Type 316 stainless steel clad fuel elements were irradiated in

EBR-2 at heating rates of approximately 30 kW/ft to burnups of 3.7 and 5.0 at. %. No clad failures occurred as a result of the irradiation. Total fission gas release from the fuel was low. Thermal stresses in the fuel resulted in fuel splitting upon initial startup and general fuel fragmentation as fission product recoil and fast neutron damage accumulated. No new phases were observed in the fuel after irradiation. Author (NSA)

N71-34639# Los Alamos Scientific Lab., N. Mex.
USE OF HIGH-RESOLUTION GAMMA-RAY SPECTROMETRY FOR DETECTING FAILURE OF CLADDING IN ENCAPSULATED FAST REACTOR FUEL PINS
J. R. Phillips, J. W. Schulte, and G. R. Waterbury May 1971 9 p refs
(Contract W-7405-eng-36)
(LA-4675-MS) Avail: NTIS

A nondestructive technique utilizing precision gamma-ray scanning was developed for detecting fuel cladding failure in doubly encapsulated fast reactor fuel elements. Detection of fission products, in particular Cs-137, outside the fuel pin envelope was used to indicate the failure. The method was tested by examining eleven mixed uranium-plutonium carbide and two mixed uranium-plutonium oxide fuel elements. Gamma-ray scanning indicated that six of the thirteen fuel elements had failed. These results were confirmed by mass spectrometric analysis of the gases in the outer encapsulation which were found to contain 11.7 to 65.0% xenon and 1.76 to 9.31% krypton. The cover gas from a seventh pin contained only 0.016% xenon and < 0.003% krypton, and the presence of Cs-137 outside the cladding was not conclusively detected by gamma-ray scanning. Cesium-137 was not found in the outer encapsulation of the six other fuel elements by gamma-ray scanning, and mass spectrometric analyses confirmed that the cladding had not failed. Author (NSA)

N71-34640# Idaho Nuclear Corp., Idaho Falls.
BURNUP DETERMINATION FOR FAST BREEDER REACTION FUELS: PROGRAM OBJECTIVES AND PLANS
W. J. Maeck and F. L. Lisman Feb. 1971 25 p refs
(Contract AT(10-1)-1230)
(IN-1456) Avail: NTIS

A new program was initiated to develop methods for the accurate determination of nuclear fuel burnup in fast breeder reactor fuels. The objectives of the program are presented and the planned experimental program is outlined. Author (NSA)

N71-34641# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CRITICAL EXPERIMENTS WITH THE UO2-2 wt PERCENT PuO2 BATCH CORE IN THE PRTR
R. I. Smith, J. W. Kutcher, J. H. Lauby, and L. D. Williams Feb. 1971 95 p refs
(Contract AT(45-1)-1830)
(BNWL-1553) Avail: NTIS

The initial phase of the batch core experiment comprising the loading of a new core of UO2-2 wt % PuO2 fuel elements and the performance of a series of critical tests to determine the physics parameters of this new core are reported. Measurements included the critical loadings for boron concentrations ranging from zero to about 21 ppm by weight (wppm) of B-10 in the D2O moderator, moderator level coefficients of reactivity over a 25-inch range of moderator heights at several boron concentrations, moderator void worths, thermal neutron flux distributions within the core, the effect of loss of coolant from fuel channels, fuel element worths, and kinetics parameters. At specified burnup levels during the batch core experiment, interim critical tests were conducted. These tests included measurements of core excess reactivity, fuel element worths, poison rod worths, and kinetics parameters. The results of these measurements are also presented. Author (NSA)

N71-34642*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
FAST NEUTRON REACTIVITY EFFECTS FOR REFRACTORY METALLIC SAMPLES MEASURED IN A THERMAL HOMOGENEOUS REACTOR
Clarence R. Pierce, Daniel Fiano, and Donald F. Shook Washington Sep. 1971 26 p refs
(NASA-TN-D-6494; E-6198) Avail: NTIS CSCL 18K

Measurements and interpretations of fast neutron reactivity effects were made for metallic samples in a thermal uranyl fluoride - water-solution reactor. Experimental reactivity coefficients were obtained for a number of refractory metals enclosed by either a thick boron-10 shell or a cadmium shell located at the center of the cylindrical reactor. Calculated reactivities were obtained using a one-dimensional spherical model of the reactor and the multigroup S sub n method. The measurements, along with the analytical procedure described, provide an integral test of fast neutron cross sections. Measured and calculated epiboron effective absorption integrals are in agreement within the uncertainty of the measurement for tungsten, tantalum, and niobium; the calculated integral underestimated measured values for molybdenum by 35 percent and overestimated the measured values for rhenium by 65 percent. Author

N71-34643# United Kingdom Atomic Energy Authority, Harwell (England).
ALPHA AUTORADIOGRAPHY OF IRRADIATED NUCLEAR FUEL
G. Trezza Nov. 1969 17 p refs Transl. into ENGLISH from Italian report RT/CHI-(69)2
(LB/G-2916) Avail: AEC Depository Libraries

The use of cellulose nitrate for the alpha autoradiography of irradiated nuclear fuel was investigated. The damage done to the cellulose nitrate by an alpha particle is described. The technique used for the autoradiography is discussed. The results showed that cellulose nitrate is very sensitive to this irradiation and can be easily detected. NSA

N71-34644 National Lending Library for Science and Technology, Boston Spa (England).
INTERACTION BETWEEN CLADDING AND OXIDE FUEL IN HIGH BURNUP FUEL ELEMENTS AT HIGH TEMPERATURES [WECHSELWIRKUNGEN ZWISCHEN HUELLE UND EXYDISCHEN BRENNSTOFF IN HOCHABGEBRANNTEN BRENNELEMENTEN BEI HOHEN TEMPEATUREN]
F. Garzarolli et al 1971 8 p refs Transl. into ENGLISH from Proc. of the Reactor Meeting of German Atomic Forum, Berlin, 22 Apr. 1970 p 525-528 In ENGLISH and GERMAN
(NLL-Windscale-459-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Eng.: 1 NLL photocopy coupon

The extent of the interaction between the fuel and the can was determined in post-irradiation X-ray fluorescence of two fuel elements which attained high burnup in the test loop of the VAK reactor. Three different types of interaction occurred in the two elements investigated: a migration of constituents of the can into the fuel; an oxidation of the can; and an intercrystalline attack. Results of the X-ray fluorescence analyses and possible mechanisms for the various interactions are presented. J.G.M.

N71-34645 National Lending Library for Science and Technology, Boston Spa (England).
PERFORMANCE OF REACTOR COMPONENTS IN A HELIUM ATMOSPHERE
J. Kolditz et al 1971 9 p Transl. into ENGLISH from Brown Boveri Rev. (Switzerland), v 52, Aug.-Sep. 1970 p 260-263 in ENGLISH and GERMAN
(NLL-EE-Trans-1933-(3774.5)) Avail: Natl. Lending Library, Boston Spa, Engl. 1 NLL photocopy coupon

Some examples from the design and operation of the AVR experimental reactor were used to show the problems caused by the use of dry and oxygen-free helium as the coolant. Two technical-physical fields considered were predominant-friction

and leak-tightness. Various possibilities for dealing with the special conditions of operating in a helium atmosphere have been outlined for some of the reactor components. Author

N71-34646 Tennessee Univ., Knoxville.
AN ANALYSIS OF THERMOCHEMICAL DEPOSITION IN SPOUTED BEDS
Ibrahim Dakhly Abdelrazek (Ph.D. Thesis) 1969 161 p
Avail: Univ. Microfilms Order No. 70-17783

The area of smooth dense microspheres of glass and steel in relatively shallow beds spouted in 2, 3, and 4 inch diameter Plexiglass columns was studied, with air as a spouting medium. The experimental values of the minimum spouting velocity and the spout diameter were correlated with the bed properties. The bed hydrodynamics were also studied. Radial and axial pressure profiles were measured in the annulus portion of the bed. The particle velocity distribution in the bed was also measured. A correlation is presented to predict the particle velocity at the top of the annulus from the bed characteristics for the case of rough particles. A model was proposed to describe the thermochemical deposition of pyrolytic carbon, from methane, on nuclear fuel microspheres in a spouted bed. Mass transfer was assumed to control the deposition process. Dissert. Abstr.

23 PHYSICS, GENERAL

Includes acoustics; cryogenics; mechanics; and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-34647*# Honeywell, Inc., Hopkins, Minn. Corporate Research Center.
AN INVESTIGATION OF OPTICAL MEMORY TECHNIQUES Final Technical Report, 1 Jul. 1969 - 30 Jun. 1970
D. Chen, R. L. Agard, F. M. Schmit, and T. S. Liu 30 Jun. 1970 127 p refs
(Contract NAS12-2194)
(NASA-CR-119897) Avail: NTIS CSCL 09C

The feasibility of utilizing thin films of MnBi for spaceborne optical mass memory applications was investigated. The MnBi materials research was concerned with acquiring the basic materials properties relevant to the optical memory applications and the improvement of the material. The optical memory experimental part of this investigation serves as a bridge between the materials research and the systems research. This effort was mainly concerned with the memory characteristics of MnBi in regard to the write, read and erase operations. The systems study defines a 10 to the 9th power to 10 to the 11th power bit optical memory system using MnBi and evaluates the feasibility of such a system based on the results obtained in the MnBi materials and optical memory experimental research. Author

N71-34648*# Martin Marietta Corp., Denver, Colo.
EVALUATION OF LIQUID METHANE STORAGE AND TRANSFER PROBLEMS IN SUPERSONIC AIRCRAFT Final Report
J. L. McGrew, D. L. Buskirk, H. F. Brady, and M. L. Leeds 6 Aug. 1971 264 p
(Contract NAS3-12411)
(NASA-CR-72952) Avail: NTIS CSCL 20L

The problems involved in using liquid methane in a supersonic cruise type aircraft were investigated. The analyses included pressurization and fuel transfer in systems using liquid methane in a saturated state, in the subcooled state, or partly as a saturated liquid and partly as a subcooled liquid. The program included designing and fabricating a test rig, conducting 49 tests, and reducing and analyzing some 100 channels of data. Three separate low-pressure tank configurations and one high-pressure tank were tested. The tests demonstrated that subcooled methane can be loaded and held for reasonable lengths of time under simulated aircraft conditions using methane vapors to maintain the pressurization. Author

N71-34649*# Lockheed Missiles and Space Co., Huntsville, Ala. Thermal Environment Section.
STUDY OF THERMAL CONDUCTIVITY REQUIREMENTS. VOLUME 1: MULTILAYER INSULATION THERMAL CONDUCTIVITY TEST PROGRAM Final Report
Mark J. O'Neill and A. J. McDanal Jun. 1971 56 p refs 3 Vol.
(Contract NAS8-26189)
(NASA-CR-119643; HREC-6189-1-Vol-1; LMSC-HREC-D225135-1-Vol-1) Avail: NTIS CSCL 20L

A detailed parametric thermal analysis of the electrical cylindrical calorimeter was performed to identify those changes which would increase the accuracy and improve the operation of the calorimeter. A detailed description of the analysis and design improvements made in the calorimeter are discussed. Also, a complete description of the calorimeter, the calorimeter's instrumentation system and automation circuitry, the method of specimen preparation and the environmental control apparatus is included. A detailed discussion of the thermal conductivity test procedure, compression test procedure and the method for obtaining physical density data is presented. Using double-aluminized mylar and Tissuglas composite as an example, the procedure for the presentation of the total data matrix of this multilayer insulation (MLI) is given. Author

N71-34650*# Lockheed Missiles and Space Co., Huntsville, Ala. Thermal Environment Section.
STUDY OF THERMAL CONDUCTIVITY REQUIREMENTS. VOLUME 2: MULTILAYER INSULATION DATA MANUAL Final Report
Mark J. O'Neill and A. J. McDanal Jun. 1971 50 p refs 3 Vol.
(Contract NAS8-26189)
(NASA-CR-119644; HREC-6189-2-Vol-2; LMSC-HREC-D225135-2-Vol-2) Avail: NTIS CSCL 20L

Multilayer insulation (MLI) composites for space thermal control systems and their unique thermophysical properties are discussed. Experimental data are presented, for the following six MLIs: (1) double-aluminized mylar and Tissuglas, (2) double-aluminized mylar and Goodyear Aerospace Company (GAC)-9 white foam, (3) double-aluminized mylar and dacron net, (4) Superfloc, (5) double-aluminized mylar and Nomex net, and (6) double-aluminized, and (6) double-aluminized mylar and cerex spunbond nylon. Author

N71-34651*# Lockheed Missiles and Space Co., Huntsville, Ala. Thermal Environment Section.
STUDY OF THERMAL CONDUCTIVITY REQUIREMENTS. VOLUME 3: ANALYTICAL AND EXPERIMENTAL HEAT TRANSFER STUDY OF A VENTING CRYOGEN TANK Final Report
Mark J. O'Neill Jun. 1971 29 p refs 3 Vol.
(Contract NAS8-26189)
(NASA-CR-119645; HREC-6189-3-Vol-3; LMSC-HREC-D225135-3-Vol-3) Avail: NTIS CSCL 20L

A subscale cryogen tank insulated with a multilayer insulation (MLI) composite was analyzed and tested to determine the applied thermal conductivity of the MLI. This approach is necessary because the MLI is degraded when it is applied to a tank by the structural supports, fasteners, compressive loading and other non-ideal conditions. The analytical predictions were made prior to the tests and were used in the development of the test plan and selection of the instrumentation. The comparisons of analytical and experimental data are presented, and show good agreement. Author

N71-34652*# National Bureau of Standards, Boulder, Colo.
CRYOGENIC RESEARCH AND DEVELOPMENT Progress Report, period ending 30 Jun. 1971
30 Jun. 1971 19 p
(NASA Order R-06-006-003)
(NASA-CR-121706; NBS-9797; Pr-42) Avail: NTIS SOD CSCL 20L

The cryogenic properties of various alloys are discussed. Three objectives of the investigation are: (1) measurement of thermal conductivities of several standard reference materials, (2) determination of the Lorenz ratio of several classes of materials, and (3) study of conduction mechanisms in alloys in the temperature range from 4 to 300 degrees K. Author

N71-34653*# Colspan, Inc., Boulder, Colo.
EXTERNAL INSULATION SYSTEMS FOR CRYOGENIC STORAGE SYSTEMS Final Study Report
Thomas M. Flynn, Jerry B. Kirgis, and John R. Wilson 17 May 1971 279 p
(Contract NAS9-10583)
(NASA-CR-115123) Avail: NTIS CSCL 20L

The merits and deficiencies of five cryogenic insulation systems for flight-weight gas storage are discussed in detail. The systems were a matted web of glass fibers, coated reflective shingles on a substrate, coated reflective shingles with embossed or tufted spacers, blankets of coated reflectors with net spacers, and continuous coated reflectors with net spacers. A parametric analysis was performed, and the structural functional relationships, thermal functional relationships, and heat transfer functional relationships were also analyzed. It was concluded that the shingles/substrate systems exhibit the best overall short term performance, and the blankets offer satisfactory long term thermal performance without many of the difficulties associated with continuous systems. N.E.N.

N71-34654# Commissariat a l'Energie Atomique, Saclay (France). Centre D'Etudes Nucleaires.
SUPERCONDUCTING MAGNET OF THE CERN BUBBLE CHAMBER [L'AIMENT SUPRACONDUCTEUR DE LA GRANDE CHAMBRE A BULLES DU CERN]
R. Florent 1970 17 p In FRENCH Presented at Panel on Superconductors, Paris, 17-18 Mar. 1970
(CEA-CONF-1735; Conf-700341-3) Avail: AEC Depository Libraries

The superconducting magnet intended for the giant bubble chamber at CERN is described, and its principal characteristics are given. The different problems which have arisen during its development are examined, and the solutions currently adopted are described. NSA

N71-34655# European Organization for Nuclear Research, Geneva (Switzerland).
SOME ASPECTS OF THE MAIN RECTIFIERS FOR THE ISR MAGNETS
O. Etgen, M. Groenenboom, J. Lisser, and S. van der Meer 4 Mar. 1971 25 p refs
(CERN-71-9) Avail: AEC Depository Libraries

The magnets of the intersecting storage rings which are fed by two 6.9 MW stabilized rectifiers, each supplying a maximum of 3750 A at 1850 V are described, as well as aspects of the rectifiers. The most important of these are: a passive filter with a current limiter that combines some advantages of damped and undamped filters; a relatively small active filter of the parallel-connected type that reduces the voltage ripple to less than 100 mV; and an unusual thyristor gate control system, designed to combine fast, linear response with a minimum amount of subharmonics generated by firing inaccuracy. Author (NSA)

N71-34656# Kernforschungszentrum, Karlsruhe (West Germany).
ARRANGEMENT FOR AUTOMATIC MAGNETIC FIELD MEASUREMENTS
J. Brandes, G. Friesinger, and A. Ulbricht May 1970 12 p refs Presented at 3d Intern. Conf. on Magnet Technol., Hamburg, 19-22 May 1970
(KFK-1220) Avail: AEC Depository Libraries

The arrangement is used for bending, quadrupole, and gradient magnets with field strengths up to 50 kG within 0.1% and assists the development of synchrotron and beam transport magnets. The measurement is done with Hall probes, coils, or resistors. The magnetic field sensors are positioned by a specially constructed measuring machine within 10 microns. All slide bearings are static air bearings to avoid stick slip and wear and tear. For automatic acquisition of the high quantities of data and for on-line control of the measurements, the measuring system is connected to a TR 86 computer. Author (NSA)

N71-34657# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
DEVELOPMENTS IN CRYOGENIC AND SUPERCONDUCTING MAGNETS
F. Arendt, H. Brechna, J. Erb, N. Fessler, G. Hartwig et al Nov. 1970 35 p refs Presented at the USSR 2d Natl. Accelerator Conf., Moscow, 10-17 Nov. 1970
(KFK-1316; Conf-701120-3) Avail: AEC Depository Libraries

The status of development work on superconducting and cryogenic magnets is described. Based on experiments with multifilament conductors, it was found that the theoretical prediction using Bean's model is confirmed down to 13 micron filament diameter. Test results of a dc superconducting quadrupole (partial derivative of B with respect to r = 37.2 T/m, with a warm aperture diameter of 0.12 m), and design studies with superconducting ac dipole magnets with ferromagnetic return yokes are reported. Work with pure aluminum tapes indicates that Kohler's rule is not fulfilled at temperatures higher than 4.2 K. Discrepancy from theory is enhanced with purity. The relative magnetoresistance is higher with increased values of residual resistivity ratio. Author (NSA)

N71-34658# Brookhaven National Lab., Upton, N.Y.
DIRAC MONOPOLE: INTRODUCTORY PAPER
B. M. Bolotovskii et al Feb. 1971 47 p refs Transl. into ENGLISH from a collection of papers entitled Dirac Monopole Sponsored by AEC
(BNL-TR-410) Avail: NTIS

The current theory of magnetic charge is discussed. The discussion also involves the interaction of the magnetic charge with matter. NSA

N71-34659# Los Alamos Scientific Lab., N. Mex.
SINGLE-SHOT PULSED MAGNETIC FIELDS FROM INDUCTIVE ENERGY STORES
Richard R. Hake Feb. 1971 44 p refs
(Contract W-7405-eng-36)
(LA-4617) Avail: NTIS

A simplified analysis is presented for the behavior of elemental pulsed-magnetic-field systems employing (1) superconducting magnets as energy stores, (2) superconducting switches with room-temperature shunts as the transfer mode, and (3) nonsuperconducting coils to furnish high-intensity (200 kG) pulsed magnetic fields. Megajoule energy pulses appear feasible, but sufficiently rapid actuation of the necessarily rather large-volume superconducting switches may be troublesome. Author (NSA)

N71-34660*# Scientific Translation Service, Santa Barbara, Calif.
INTERACTION OF LIGHT AND SOUND [VZAIMODEYSTVIYE SVETA I ZVUKA]
I. L. Fabelinskiy Washington NASA Sep. 1971 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Fiz., v. 35, no. 5, 1971 p 874-882
(Contract NASw-2035)

(NASA-TT-F-13902) Avail: NTIS CSCL 20A

Gas lasers are used to measure the velocity and absorption of longitudinal hypersonic waves. It is concluded that excitation of hypersound by thermal stresses produced by absorption of short light impulses holds great promise for the study of hyperacoustic properties of a solid body at room temperature. Author

N71-34661# Physics Lab. RVO-TNO, The Hague (Netherlands).
REVERBERATION MEASUREMENTS ON MODEL SCALE
A. N. Eken Jan. 1971 31 p refs
(PHL-1971-5; TDCK-58080) Avail: NTIS

Back-scattering results for a model of a sea-surface are presented. Measurements were carried out at a scale-factor of 1:100 in an anechoic lined water tank at a frequency of 500 kHz. The sea surface was imitated by rough plates of polyurethane foam and glass. Author

N71-34662# California Univ., Berkeley. Lawrence Radiation Lab.
RESIDUAL FIELDS IN SUPERCONDUCTING DIPOLE AND QUADRUPOLE MAGNETS
Michael A. Green Feb. 1971 11 p refs Presented at the Natl. Particle Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20171; Conf-710308-24) Avail: NTIS

The technique used to measure residual fields is described. The results of the measurement are presented and compared with a simplified theory, which predicts the basic nature of residual fields. The theory and experiment agree reasonably well despite the simplifying assumptions made in the theory. The residual fields generated in a superconducting magnet do effect the uniformity of the field generated in such a magnet. The effects of residual fields are worst at low fields, which is precisely where one wants the most magnet uniformity in a superconducting synchrotron. The theory suggests that one can reduce the magnitude by: (1) reducing the strand diameter in the material (smaller strands require more twist to eliminate coupling); and (2) reducing the low field critical current of the material, which also reduces ac loss and instabilities. The theory also suggests that superconducting synchrotrons with injection inductions as low as 1 kG must have superconductor strands as small as 1 to 2 micrometers. Author (NSA)

N71-34663# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
EQUATION OF STATE FOR SOLID HYDROGEN
Thomas Alexander Bruce Mar. 1971 27 p refs
(Contract AT(30-1-3699)
(NYO-3699-52) Avail: NTIS

An equation of state for solid hydrogen is obtained from variational calculations for pressures up to 112 K-bars. The Lennard-Jones potential is assumed and a brief investigation of the Buckingham Exp-6 potential is also made. It is suggested that for high densities, quantum crystals may become harmonic and that Monte Carlo variational calculations for these high density regions may not be necessary. Author

N71-34664# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
LOW TEMPERATURE ELECTROMAGNETIC GENERATION OF ULTRASOUND IN POTASSIUM
W. D. Wallace, M. R. Gaerttner, and B. W. Maxfield Apr. 1971 13 p refs
(Contract AT(30-1)-2150)
(NYO-2150-72) Avail: NTIS

The magnetic field dependence of electromagnetic generation of 9.4 MHz ultrasound in potassium below 4.2 deg was measured and compared with calculations based upon a free electron model of the metal. It is found that substantial differences exist between the experimental results and predictions of the theory. Author

N71-34665# California Univ., Berkeley. Lawrence Radiation Lab.
COOLING INTRINSICALLY STABLE SUPERCONDUCTING MAGNETS WITH SUPERCRITICAL HELIUM
Michael A. Green Feb. 1971 4 p refs Presented at the Natl. Particle Accelerator Conf., Chicago, 1-3 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20172; Conf-710308-26) Avail: NTIS

A supercritical helium-cooled magnet is described. This magnet, built at LRL, utilizes an intrinsically stable, low-ac-loss superconductor. The heat generated with the coil is conducted to supercritical helium cooling tubes adjacent to the magnet coil. (Several superconducting synchrotron groups have suggested this method for cooling pulsed magnets.) The experimental equipment, which differs considerably from the normal superconducting magnet system, is described. The problems associated with cooling the magnet are discussed, and the operating characteristics of the coil are presented. Author (NSA)

N71-34666# California Univ., Berkeley. Lawrence Radiation Lab.
END EFFECTS IN SUPERCONDUCTING BEAM-TRANSPORT MAGNETS
Robert B. Meuser Feb. 1971 4 p refs Presented at the Natl. Particle Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20184; Conf-710308-28) Avail: NTIS

Superconducting dipole or multipole magnets which provide magnetic fields transverse to the axis of a right circular cylinder for beam transport are considered. The integral theorem criterion for judging the quality of a magnet is outlined, and several configurations for reducing the aberrations at the ends of magnets are described and discussed. NSA

N71-34667# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
ON THE ELECTRICAL BEHAVIOR OF AIR SPARK CHANNELS SUBJECTED TO CURRENT SHOCKS [ZUM ELEKTRISCHEN VERHALTEN VON LUFTFUNKENSTRECKEN UNTER STOSSSTROEMEN]
Juergen Moeller (Ph.D. Thesis) 1970 299 p refs In GERMAN
Avail: NTIS

Electrical and optical measurements on spark channels with quiet and triggered current arcs are used to investigate shock arc migration and optimization. It is shown that arc velocity is proportional to the current energy if spark trajectory parameter variations are kept in bounds (s = 1...4 mm). Shock wave channel expansion dominates the spark trajectory for about 10 microseconds; after expansion to a wider ribbon a migrating arc is formed. Optimal conditions for the migrating arc ribbon are a minimum partial linear distance of up to 2 mm and a small side opening angle. Transl. by G.G.

N71-34668# Tokyo Univ. (Japan). Inst. for Nuclear Study.
FIELD MEASURING SYSTEM OF DRIFT TUBE QUADRUPOLE MAGNETS
Masaki Kobayashi, Jiro Tanaka, Sukeshi Yamashita, and Hitoshi Babe Feb. 1971 25 p refs
(SJC-A-71-1) Avail: AEC Depository Libraries

An apparatus for centering drift tube quadrupole magnets and measuring their harmonic field components is described together with the search coil and its calibration method. Sensitivity within 0.5 microns and reproducibility within 2 microns can be obtained for the magnetic center location. Harmonic field components in four types of model magnets were measured for different pole shapes. Author (NSA)

N71-34669 Cornell Univ., Ithaca, N.Y.
THEORETICAL AND EXPERIMENTAL STUDIES OF THE OPTICAL SATURATION OF VIBRATION-ROTATION TRANSITIONS IN MOLECULAR GASES
Nicholas I-Tsing Djeu. (Ph.D. Thesis) 1970 101 p

Avail: Univ. Microfilms Order No. 70-17075

A theory for the saturation of optical radiation which is resonant with a pair of vibration-rotation levels in a molecular gas is developed. The saturation formula is a function of the frequency and the intensity of the saturating field, the rotational relaxation rate, the dephasing collision rate, and an effective vibrational relaxation rate, and is valid for arbitrarily strong fields. The theory predicts that in a limited pressure region saturation in a multi-level molecular system follows the same pattern as in a two level system, with the rotational relaxation rate representing the level decay rate. It also predicts a collision-induced power broadening feature at elevated pressures. A well resolved vibration-rotation transition in the nu sub 3 band of SF6 is found at 200 K. Saturation measurements have been performed on that transition, and the validity of the saturation formula in the low pressure limit established. The collision-induced power broadening aspect was verified by studying the output of a single mode CO2 laser. Dissert. Abstr.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-34670*# Pittsburgh Univ., Pa.

PRODUCTION OF CO(a 3 PI) AND OTHER METASTABLE FRAGMENTS BY ELECTRON IMPACT DISSOCIATION OF CO2

W. C. Wells, W. L. Borst, and E. C. Zipf Jul. 1971 19 p refs

(Grant NGL-39-011-030)

(NASA-CR-121714; SRCC-155) Avail: NTIS CSCL 20H

The dissociative excitation of CO(a 3 PI) and other fragments such as O(5S0) was investigated from threshold to 50 eV. The observed threshold for CO(a 3 PI) production at (11.9 + or - 0.5) eV was near the minimum required energy of 11.5 eV. Assuming an isotropic distribution of CO(a 3 PI) fragments after dissociation, the cross section for dissociative excitation of CO(a 3 PI) from CO2 was found to be about 3.6 x 10 to the minus 17th power sq cm at 20eV. The time of flight data was also used to infer a value for the CO(a 3 PI) dissociative excitation cross section from Ajello's relative cross section measurements (1971 A) and a slightly lower value of 1.6 x 10 to the minus 17th power sq cm at 20eV was obtained. These experiments imply a maximum cross section value of (4.1 + or - 3.0) x 10 to the minus 17th power sq cm at 27 eV. The differential cross section for the dissociative excitation of CO(a 3 PI) at right angles to the electron beam was found to be (3.0 + or - 2.2) x 10 to the minus 18th power sq. cm/sterad at an energy of 20 eV. Author

N71-34671*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

MOLECULAR COLLISIONS. 16: COMPARISON OF GPS WITH CLASSICAL TRAJECTORY CALCULATIONS OF ROTATIONAL INELASTICITY FOR THE Ar-N2 SYSTEM

M. D. Pattengill, R. A. La Budde, R. B. Bernstein, and C. F. Curtiss 18 Jun. 1971 28 p refs

(Grants NGL-50-002-001; NSF GP-12832; NSF GB-16665)

(NASA-CR-121712; WIS-TCI-441) Avail: NTIS CSCL 20H

The classical limit of the infinite order generalized phase shift (GPS) treatment of rotationally inelastic atom-molecule collisions was applied to a model problem intended to approximate thermal scattering of the Ar-N2 system (collisional energy of 3/2 kT at 300 deg K). The GPS predictions were then compared to the exact classical trajectory (CT) results. This comparison indicates that the present version of the GPS method overestimates the rotational excitation and underestimates the de-excitation, while maintaining the total inelasticity at approximately the correct (CT) value. Author

N71-34672*# Pittsburgh Univ., Pa.

DISSOCIATIVE EXCITATION OF VACUUM ULTRAVIOLET EMISSION FEATURES BY ELECTRON IMPACT ON MOLECULAR GASES. 1: H2 AND O2

M. J. Mumma and E. C. Zipf May 1971 38 p refs

(Grant NGL-39-011-030; Contract DA-31-124-ARO/D/-440)

(NASA-CR-121710; SRCC-152) Avail: NTIS CSCL 20H

The HI(2p1 2p to 1s1 2S) 1215.67 A Lyman alpha line and the OI(3s1 3S0 to 2p4 3p) 1302.17, 1304.87, 1306.04 A multiplet were excited by electrons impacting on H2 and O2, respectively. Their excitation cross sections were measured over the energy range from threshold to 350 eV. The cross section for dissociative excitation of Lyman alpha has a peak value of 1.23 x 10 to the minus 17th power sq cm + or - 11% while the cross section for the OI 1300 A multiplet has a maximum value of 3.8 x 10 to the minus 18th power sq cm + or - 17%. The cross section for dissociative excitation of the O1(3s1 1p0 to 2p4 1S) 1217.6 A line is 1.5 x 10 to the minus 19th power sq cm + or - 24% at 100 eV. Author

N71-34673*# Wisconsin Univ., Madison. Theoretical Chemistry Inst.

EXACT QUANTUM CROSS SECTIONS FOR A THREE DIMENSIONAL ANGLE DEPENDENT MODEL FOR THREE BODY REACTIONS

Michael Baer (Houston Univ.) and Donald J. Kouri (Houston Univ.) 30 Jul. 1971 9 p refs

(Grant NGL-50-002-001)

(NASA-CR-121742; WIS-TCI-450) Avail: NTIS CSCL 20H

Exact quantum mechanical reactive cross sections are reported for a three dimensional angle dependent model surface. The surface simulates an atom-heteronuclear diatom system A + BC yields AB + C where atom B is much heavier than A or C. The molecules BC and AB are taken to be rotating vibrators which can dissociate. Results for two angle dependent potentials are given. Author

N71-34674# Scientific Translation Service, Ann Arbor, Mich.

DOSAGE CHARACTERISTICS OF 200 MeV PROTONS

M. Zelchinskii et al [1970] 9 p refs Transl. into ENGLISH from Russian report Sponsored by AEC Prepared for Oak Ridge Natl. Lab.

(ORNL-tr-2460; JINR-P16-5383; STS-10344) Avail: NTIS

The dose characteristics of protons with energy 200 MeV are found experimentally by recombination methods for which there are detailed theoretical calculations. The absorbed dose rate, related to unit density proton flux (P), and quality factor (QF) at the depth 5 cm in an infinite time-equivalent slab 30 cm thick for the case of normal irradiation with a broad parallel monoenergetical proton beam are taken as compared parameters. The values P = 81 8 nrad/prot sq cm and QF = 1.40 0.25 rem/rad, obtained experimentally, testify that theoretical calculations have been based on the right assumptions with respect to cross section values and model of interaction process. Author (NSA)

N71-34675# Los Alamos Scientific Lab., N. Mex.

MEASURED U 235 AND U 238 FISSIONING NEUTRON FLUENCE DISTRIBUTIONS IN THE PHOEBUS 2A SHIELDS: COMPARISONS WITH MONTE CARLO CALCULATIONS

Clayton W. Watson Nov. 1970 33 p refs

(Contract W-7405-eng-36)

(LA-4615) Avail: NTIS

Fissioning-fluence distributions for U-235 and U-238 were measured in the facility and cart shields during the Phoebus 2A reactor tests. These data formed a diagnostic basis for upgrading both the neutron Monte Carlo codes and the Phoebus 2A reactor models being used for Rover neutron environmental calculations. Detailed comparisons with corresponding distributions calculated with both initial and improved codes and models are presented. Initial calculations gave results that were in poor to fair

agreement with experiment, whereas the improved calculations were generally in good to excellent agreement. The changes required to achieve this agreement are discussed. Auxiliary studies and data, including calculated fission and absorption-rate distributions throughout a 5000-MW Phoebus 2A reactor shield system, are presented in appendixes. Author (NSA)

N71-34676# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ON NEW POSSIBILITIES OF QUICK RECORDING OF PARTICLE TRACKS IN CONDENSED MEDIA
A. F. Pisarev 1971 18 p refs In RUSSIAN
(JINR-P13-5623) Avail: AEC Depository Libraries

Methods of quick recording of particle tracks in condensed media are considered. Some of them are based on the impact multiplication of primary charges in the particle tracks on the impurity levels, artificially populated by electrons, in cooled solid states. A number of methods is based on the effect of enhanced tunnel penetration of electrons in the points where particles are passing through the thin layers of semiconductors and dielectrics. Author (NSA)

N71-34677# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
UNIVERSAL PULSE SHAPER FEU
V. I. Rykalin and Z. Tsisek 1971 19 p In RUSSIAN
(JINR-P13-5689) Avail: AEC Depository Libraries

A double-channel pulse shaper FEU is described. The operation threshold of the shaper is 100 mV. Output pulse duration is varied within 10 to 100 nsec. Speed of response of the shaper is 100 MHz. One channel of the shaper has no dead time. Author (NSA)

N71-34678# Institute of Nuclear Research, Warsaw (Poland).
APPLICATION OF SEMICONDUCTOR DETECTORS FOR X-RAY FLUORESCENT ANALYSIS [ZASTOSOWANIE DETEKTOROW POLPRZEWODNIKOWYCH DO CELOW ANALIZY FLUORESCENCYJNEJ PROMIENIOWANIA X]
J. Chwaszczewska, K. Dybowski, B. Sawika, and J. Tys 1971 14 p refs In POLISH; ENGLISH summary
(INR-1274; Rept-4274/IA/II/IXA/PS) Avail: AEC Depository Libraries

A possibility of quantitative fluorescent analysis of metal and salt samples was tested using a Si(Li) spectrometer. The characteristic X-rays of measured samples were excited by 1 mCiAm 2241 or 3 mCi-Cd-109 gamma rays and by H(+) and Xe(+) ions accelerated up to 100 to 200 keV by the GN-200 accelerator. The energy resolution of the Si(Li) spectrometer was 1 keV for a 6 keV gamma ray. The lower limit of the spectrometer sensitivity was about 4 keV. Author (NSA)

N71-34679# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
FORMATION OF GAS BUBBLES IN FISSILE MATERIAL DURING REACTOR IRRADIATION
A. D. Whapham Nov. 1970 35 p refs
(AERE-R-6595) Avail: AEC Depository Libraries

The formation of fission gas bubbles in solids was considered in conditions where the resolution of gas from bubbles is appreciable. In such conditions the Greenwood theory is shown to apply only at high temperatures and short irradiation times. At low temperatures precipitation is delayed at short irradiation times. For longer irradiation times at all temperatures, the irradiation enhanced generation rate due to resolution of gas from bubbles outweighs the natural generation rate and the number of nuclei increases linearly with time until numbers are eventually limited by the agglomeration of bubbles by random motion. The number of bubbles predicted by this nucleation-agglomeration theory agrees with experimental observation in the case of uranium dioxide, but may not agree in the case of uranium, for which the resolution parameter may not be high enough. The effect of the theoretical predictions of bubble number and size on swelling and gas migration is discussed for uranium dioxide Author (NSA)

N71-34680# Institute of Nuclear Research, Warsaw (Poland).
STANDARDIZATION OF BETA-GAMMA EMITTERS BY 4 PI BETA-GAMMA COINCIDENCE METHOD
A. Chylinski and I. Radoszewski 1970 28 p refs
(INR-1240) Avail: AEC Depository Libraries

The theory of the 4 pi beta-gamma coincidence method is given with all corrections and counting errors. The counting equipment is described, and some investigations of the detectors to find the optimal conditions of counting are discussed. The described method was checked by measurements of Co-60 solutions. The 4 pi beta-gamma coincidence method was applied for standardization of nuclides: I-131, Zr-95, Co-144 + Pr-144, Sb-125, Sc-46, Nb-95, Eu-152, Eu-155, Na-22, Ca-134. Author (NSA)

N71-34681# Institute of Nuclear Physics, Krakow (Poland).
PROCEEDINGS OF THE X CRACOW SCHOOL OF THEORETICAL PHYSICS. VOLUME 2: SCATTERING OF COMPOSITE OBJECTS
Jun. 1970 163 p refs
(INP-713-Vol-2; Rept-713/PL/PH) Avail: AEC Depository Libraries

Lectures given during the session are presented. Subjects discussed included: (1) single pion photoproduction in the resonance region W = 1-2 GeV; (2) experimental information about multiple meson production at superhigh energies; (3) hypernuclei and hypernuclear spectroscopy; (4) non-polynomial Lagrangians and the Parton model of high energy collisions; (5) Regge cut phenomenology; (6) survey of the quark model for hadronic states; (7) Veneziano n-point function symmetric representations and their implications; and (8) connection between particles and poles of the S-matrix. For Volume 1, see N71-29163. A.L.

N71-34682# Atomic Energy Board, Pretoria (South Africa).
ENVIRONMENTAL RADIOACTIVITY AT THE NATIONAL NUCLEAR RESEARCH CENTRE, PELINDABA, 1969
D. van As, H. O. Fourie, and Constance M. Vleggaar Oct. 1970 33 p refs
(PEL-205) Avail: AEC Depository Libraries

Measurements made during 1969 of gross radioactivities and certain individual nuclides in samples of soil, vegetation, water, sediment, water plants, fish, milk, and agricultural products from the environment around the National Nuclear Research Center (NNRC) at Pelindaba, are reported. Gross activities are compared with values of previous years. The results of fallout measurements are included. No increases in environmental radioactivity due to the operations at the NNRC could be detected. Author (NSA)

N71-34683# Israel Atomic Energy Commission, Tel Aviv.
MONTE CARLO PROGRAM FOR CALCULATING THE INTERACTIONS BETWEEN A NUCLEAR SPECTROMETER AND A PULSE GENERATOR AT HIGH COUNTING RATES
Miguel Wiernik Sep. 1970 50 p refs
(IA-1231) Avail: AEC Depository Libraries

The program DEADTIME was written in order to calculate the extent of the interactions between the pulses from a pulse generator and a multichannel analyzer when the former is used to correct the measurements of the latter for dead-time effects. The accuracy and the precision of the correction factor can be calculated beforehand for each particular set of conditions and instruments. The accuracy was found to depend only on the ratio between the rates of the pulses from the pulse generator and the detector. Instructions for the choice of the best working conditions are given. The use of a pulse generator is especially recommended for the measurement of very short-lived nuclides where the dead-time varies continuously and cannot be compensated for automatically by means of a live-timer. Author (NSA)

N71-34684# Atomic Energy Board, Pretoria (South Africa).
PEAK: A COMPUTER PROGRAMME FOR THE ANALYSIS OF TIME OF FLIGHT SPECTRA
J. W. Tepel Nov. 1970 47 p refs
(PEL-277) Avail: AEC Depository Libraries

The program identifies the background and approximates it by a straight line or parabola, after which complex peak formations are resolved into their constituent lines by the multiple superposition of a reference peak of any predetermined shape. The height, width, and position as variable parameters in a least squares procedure were used in the investigation. No prior information on the position or number of lines is needed.
Author (NSA)

N71-34685# Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Vienna.
DEVELOPMENT OF A DETECTOR WITH LOW BACKGROUND FOR COUNTING LIGHT, LOW ENERGY IONS [ENTWICKLUNG EINES DETEKTORS MIT NIEDRIGEM LEERWERT ZUR ZAEHLUNG LEICHTER, NIEDERENERGETISCHER IONEN]
Oswald Benka (Ph.D. Thesis - Vienna Univ.) 1970 84 p refs
In GERMAN; ENGLISH summary
(SGAE-PH-103/1970) Avail: AEC Depository Libraries

For investigating the beta-decay of the neutron, an energy-independent detector was developed to count the low energy (150 to 800 eV) recoil protons. Since only a few protons are expected per minute, background should be low. The detector is an improved ion-electron converter. Ions entering the ion-optical system are accelerated to -25 kV and hit a foil at an angle of 45 deg. Ions of different energies are focussed at the foil by using a variable potential on one lens diaphragm. Secondary electrons are ejected from both sides of the foil, accelerated in opposite directions, focussed upon two separate scintillators, and counted in coincidence. The foil is thin enough to prevent heavier ions from being counted. Since the foil is in an almost field-free space and because of the coincidence condition, the background contributions due to field emission and due to scintillator-photomultiplier noise are reduced. The necessary ion-optical systems are developed and calculated by a computer program.
Author (NSA)

N71-34686# Commissariat a l'Energie Atomique, Saclay (France). Centre D'Etudes Nucleaires.
PHONON SCATTERING AND INDUCED ENERGY LEVELS IN ELECTRON-IRRADIATED Sb-DOPED Ge IN THE n- TO p-TYPE CONVERSION REGION
G. Laurence and H. J. Albany [1970] 14 p refs Presented at Intern. Conf. on Radiation Effects and Semiconductors, Albany, 24-26 Aug. 1970
(CEA-CONF-1745; Conf-700824-2) Avail: AEC Depository Libraries

Low-temperature thermal-conductivity measurements on Sb-doped Ge are reported. The change in K with electron dose was investigated in the n- to p-type conversion region of two Sb concentrations. The thermal-conductivity behavior was shown to arise from electron-phonon scattering in relation to the antimony levels, irradiation-induced energy levels, and their charge states. Hall-effect measurements made at the different stages observed in the K variation indicate the dominant effects of the induced levels. The existence of a residual scattering near the n-p transition is a striking feature that might indicate the particular role or structure of the acceptor centers in this region.
Author (NSA)

N71-34687# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.
EXPONENTIAL DECAY LAW OF NONSTABLE PARTICLE
M. V. Terentev 1970 67 p refs In RUSSIAN; ENGLISH summary
(ITEF-773) Avail: AEC Depository Libraries

The problem of time dependence of the probability of decay of unstable particle is studied. It is argued that in the framework of quantum mechanics the exponential decay law exp(gammat) must be valid practically at any values of time t, or more precisely, the better the experimental setup, the further the exponential decay law may be seen.
Author (NSA)

N71-34688# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
THREE DIMENSIONAL RELATIVISTIC EQUATION IN APPLICATION TO THE PARTICULAR PROBLEMS OF THE THREE-BODY THEORY
V. M. Vinogradov 1971 17 p refs In RUSSIAN
(JINR-P2-5661) Avail: AEC Depository Libraries

On the basis of the relativistic faddeev equations obtained in the framework of the three-dimensional formulation of quantum field theory, the following questions are considered. These are as follows:(1) separable approximation in the two- and three-body problem (2) partial analysis of the three-body equations, and (3) high-energy scattering on the complex weakbound system. Some arguments in favor of replacing the nonrelativistic equations by the relativistic ones, which lead to increasing of the energy of the bound states, are given. It is shown that the well-known Glauber's formula for problem(3) can be obtained under stronger assumption about behavior of the two-particle amplitude at high energies.
Author (NSA)

N71-34689# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
MEASUREMENT OF THE LIGHT YIELD OF THE CsI(Tl) CRYSTAL BOMBARDED WITH THE PROTONS, DEUTERONS, AND TRITONS IN THE ENERGY REGION 15 - 100 MeV
Yu. G. Budyashov, V. G. Zinov, A. D. Konin, A. I. Mukhin, and A. M. Chatrchyan 1971 6 p refs In RUSSIAN
(JINR-P1-5682) Avail: AEC Depository Libraries

It is shown that, within measurement errors, the light yield of the CsI(Tl) crystal bombarded with protons, deuterons, and tritons in the energy region 15 to 100 MeV is equal and depends linearly on the energy.
Author (NSA)

N71-34690# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik.
PRODUCTION OF POLARIZED DEUTERIUM IONS WITH A LAMB-SHIFT SOURCE [ERZEUGUNG VON POLARISIERTEN DEUTERIUMIONEN MIT EINER LAMBSHIFTQUELLE]
V. Bechtold, , H. Brueckmann, D. Finken, L. Friedrich et al Jul. 1970 17 p refs In GERMAN; ENGLISH summary Presented at the Joint Meeting of the Ger. and Dutch Phys. Soc., Eindhoven, Neth., Apr., 1970
(KFK-1256; Conf-700417-3) Avail: AEC Depository Libraries

The production and the selective ionization of metastable hydrogen atomic beams are investigated by different charge-exchange collisions. The experiments aimed at a profitable use of the Lamb shift for the production of polarized-hydrogen-ion beams. The selectivity of the charge-exchange reactions turns out to decrease with increasing energy in the region between 0.5 and 5.0 KeV/ This general behavior can be understood qualitatively from the pseudocrossing theory. The production of metastable hydrogen atoms by charge-exchange collisions shows, in different gases, only a high yield if the energy defect of the reaction is small. The experimental results agree qualitiatively with calculations for nonresonant charge-exchange collisions. Some characteristic results achieved with the Karlsuhe Lamb-shift source A-LASKA and the application to the production of polarized deuterium ion beams are discussed.
Author (NSA)

N71-34691# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
PHASE SHIFT ANALYSIS OF pp SCATTERING AT 1 GeV
L. N. Glonti, Yu. M. Kazarinov, A. M. Rozanova, and I. N. Silin

1971 16 p refs In RUSSIAN
(JINR-P1-5737) Avail: AEC Depository Libraries

In order to plan experiments on the elastic NN-scattering at 1GeV, the phase-shift analysis of the known experimental data on pp-scattering was performed. The results show that for an accurate determination of the pp-scattering amplitude at this energy, the measurement of the triple scattering parameters is to be made. Experimental data on the elastic pp-scattering near 1 GeV are listed. Author (NSA)

N71-34692# Institute of Nuclear Research, Warsaw (Poland).
POLARIZATION OF NEUTRONS FROM THE H-3(d,n)He-4 REACTION AT LOW DEUTERON ENERGIES
M. Sieminski, Z. Wilhelmi, W. Zych, P. Zupranski, and J. Rondio 1970 3 p refs
(INR-1252) Avail: AEC Depository Libraries

The results of measurements of neutron polarization from the H-3(d,n)He-4 reaction are presented. Variation of neutron polarization vs deuteron energy has been studied at neutron emission angles 60 and 90 deg in the laboratory system for deuteron energies from 0.5 to 1.6 MeV. Angular distribution of neutron polarization has been measured at a deuteron energy of 1.4 MeV. Author (NSA)

N71-34693# Institute of Nuclear Research, Warsaw (Poland).
EMISSION OF DEUTERONS IN INTERACTIONS OF 9 GeV PROTONS WITH LEAD NUCLEI
P. Ciok 1971 13 p refs
(INR-P-1256) Avail: AEC Depository Libraries

The emission of deuterons with energies ranging from 17 to 110 MeV in interactions of 9 GeV protons with lead nuclei was studied using nuclear emulsion. These deuterons constitute about 1/6 of the secondary heavily ionizing particles. The results concerning the slower deuterons are consistent with the predictions of the evaporation model. Some observed features of the emission of the remaining deuteron part can be interpreted in terms of the mechanism proposed previously. Author (NSA)

N71-34694# Institute of Nuclear Research, Warsaw (Poland).
ON THE CALCULATION OF D SUB LAMBDA IN THE PHASE-SHIFT APPROXIMATION
S. Borodziuk and J. Dabrowski 1970 12 p refs Submitted for publication
(INR-P-1239) Avail: AEC Depository Libraries

The accuracy of the phase-shift approximation in calculating the well-depth of a Lambda hyperon in nuclear matter D sub Lambda is investigated. A model case of a simple Lambda hyperon nucleon potential is considered. The value of D sub Lambda calculated in the phase-shift approximation is about 10 MeV bigger than the value obtained by the complete K-matrix method. This indicates that the phase-shift approximation is too rough for an application in the D sub Lambda problem.
Author (NSA)

N71-34695# Institute of Nuclear Research, Warsaw (Poland).
LOW, INTERMEDIATE, AND HIGH ENERGIES IN THE VENEZIANO MODEL FOR THE KN SCATTERING
J. Namyslowski, Z. Rek, and M. Swiecki 1970 28 p refs
(INR-P-1228) Avail: AEC Depository Libraries

The low-energy constraints of consistency of two Alder-Weisberger sum rules, the Adler requirement, and the isospin zero KN scattering length equal zero are built in the Veneziano type model, with unobserved parity doublets of particles. Predictions of the amplitude are checked with the experimental data for the elastic widths of resonances differential cross sections of the charge exchange process kaon(+) neutron yield kaon(0) proton and the elastic backward kaon(+) proton scattering at energies ranging from 1 up to 12.3 GeV. A reasonable qualitative agreement is found at all energies.
Author (NSA)

N71-34696# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
INELASTIC ELECTRON-PHOTON SCATTERING
T. F. Walsh Mar. 1971 12 p refs
(DESY-71/15) Avail: AEC Depository Libraries

It is suggested that colliding positron electron beam machines may be used to study inelastic electron-photon scattering. Author (NSA)

N71-34697# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
W PRODUCTION IN NUCLEON-NUCLEON COLLISIONS
Z. Kunszt 9 Apr. 1971 16 p refs Submitted for publication
(JINR-E2-5748) Avail: AEC Depository Libraries

The cross section for the production of the intermediate vector boson in high-energy nucleon-nucleon collisions is estimated in some of the models proposed for the description of the highly inelastic processes. An expression for the total cross section is obtained, which is a smooth function of the c.m. energy and the mass of the W-boson. Author (NSA)

N71-34698# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
TABLES OF INTENSITY OF TRANSITION RADIATION FOR NON-RELATIVISTIC PARTICLES
A. P. Kobzev, S. Michalek, and J. Rutkowski 1971 21 p refs In RUSSIAN
(JINR-P4-5690) Avail: AEC Depository Libraries

The angular distribution of the transition radiation, excited by nonrelativistic particles when crossing the vacuum-medium boundary, are calculated for different indexes of refraction and the absorption coefficients. Author (NSA)

N71-34699# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
LOWER BOUNDS FOR SCATTERING PARAMETERS
B. N. Zakharev, O. Ukhegva, S. A. Niyazgulov, and Yu. I. Fenin 1971 12 p refs In RUSSIAN
(JINR-P4-5660) Avail: AEC Depository Libraries

A theorem on lower bounds for the scattering K-matrix in reactions of the most general type (including disintegration of the system into three and more fragments) is proved.
Author (NSA)

N71-34700# Joint Inst. for Nuclear Research, Dubna (USSR).
CERTAIN CHARACTERISTICS OF FAST DEUTERON INTERACTIONS WITH NUCLEI
K. K. Gudima, A. D. Kirillov, V. D. Tonseev, and Yu. P. Yakolev 1970 11 p refs In RUSSIAN
(JINR-P2-5261) Avail: AEC Depository Libraries

The interaction of fast deuterons with nuclei in a photoemulsion was investigated. The 600-MeV deutrons were obtained in an electrostatic separation channel at an intensity of 20 deuterons per 1 x 10 to the 10th power incident protons. The 250-microns thick photoemulsion was irradiated by this beam up to a rate of 0.5 x 100,000 particles/cucm at the highest track density region. The experimental correlations were based on the statistical study of 500 stars. The results revealed inelastic deuteron-nucleon collision data involving 2 independent nucleon cascades does not yield sufficient information concerning the behavior of individual components. It is possible that the reaction mechanism involved is more complex than has been assumed, as indicated in the case of some of the large stars. The lowered theoretical yield in the 60 to 120 deg angular range may be attributed ot the fact that the quasi-free scattering of deuterons on the nucleons was not taken into account. NSA

N71-34701# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
DIFFERENTIAL CROSS SECTION AND VECTOR POLARIZATION FOR THE ELASTIC SCATTERING OF 41 TO 61

MeV DEUTERONS ON CARBON
W. Fetscher, K. Sattler, M. D. Schmeing, E. Seibt, R. Staudt et al Jan. 1971 16 p refs Presented at 3d Intern. Symp. on Polarization Phenomena in Nucl. Reactions, Madison, Wis., 31 Aug. - 1 Sep. 1970
(KFK-1357; Conf-700811-15) Avail: AEC Depository Libraries

Differential cross section and vector polarization for the elastic scattering of 41, 46, and 51 MeV deuterons on C-12 were obtained from single and double scattering experiments at the Karlsruhe isochronous cyclotron. Tensor polarization effects were found to be small. The experimental data are compared with the results of optical model calculations. Best fits to the polarization data are obtained with volume spin-orbit terms for the deuteron optical potential. Author (NSA)

N71-34702# Democritus Nuclear Research Center, Athens (Greece).
POSSIBILITY OF OBTAINING ASYMPTOTICALLY DECREASING EFIMOV AMPLITUDES
C. G. Georgalas Mar. 1971 7 p refs
(DEMO-71/7) Avail: AEC Depbsitory Libraries

The pion + pion yields pion + pion interaction is discussed using a nonpolynomial interaction Lagrangian. The possibility of obtaining asymptotically decreasing Efimov amplitudes is considered. NSA

N71-34703# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
MODEL FOR VECTOR-VECTOR-TENSOR MESON COUPLING CONSTANTS
B. Renner Mar. 1971 10 p refs
(DESY-71/14) Avail: AEC Depository Libraries

By the joint assumptions of vector meson dominance for the electromagnetic current and tensor meson dominance for the energy-momentum tensor a model for the vector-vector-tensor meson vertex is developed, including also the coupling of two photons to a tensor meson and the coupling of one photon to the vector-tensor meson system. In its simplest possible form the model has no undetermined parameters. Tentatively the vertex is applied to compute a tensor-meson exchange contribution to vector-meson scattering from an unpolarized target, and s-channel helicity conservation is found at large energies. Author (NSA)

N71-34704# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Kernphysik.
NEUTRON SCATTERING FROM SOLID HYDROGEN
W. Schott and H. Rietschel Nov. 1970 27 p refs
(KFK-1327) Avail: AEC Depository Libraries

By inelastic neutron scattering, the quadrupole interaction constant ratio in solid hydrogen was determined to be 0.74, 0.77, and 0.81 for ortho concenerations c = 0.68, 0.27, and 0.04, respectively. The phonon spectrum of solid hydrogen in the hexagonal-close-packed phase (c = 0.68) was obtained from the scattering distribution. Author

N71-34705# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
MODIFIED SCALAR FIELD EQUATION AND CLOSED WORLD WITH FIELD SOURCES
R. A. Asanov 1971 12 p refs In RUSSIAN
(JINR-P2-5738) Avail: AEC Depository Libraries

Some properties of static solutions of the Penrose equation in the presence of a point field source are considered. The exact solution of Einstein's equations (without cosmological term) in the presence of dust-like matter and Chernikov-Tagirov scalar field sources is given. The solution is the closed static isotropic world. Results are compared with the ordinary scalar field equation. Author (NSA)

N71-34706# Tokyo Univ. (Japan). Inst. for Nuclear Study.
CALIBRATION OF BEAM MONITORS
Yoshio Akino, Kumataro Ukai, Hedeki Okuno, Seiji Kabe, and Masaaki Kasuya Jul. 1970 24 p refs In JAPANESE
(INS-TH-66) Avail: AEC Depository Libraries

The calibration constants of a quantameter (QM) and a thick-walled ion chamber (TC), their energy dependence, and the charge loss due to ionic bond are presented. The total energy U of the gamma-ray which enters the QM or the TC and the charge q generated in the QM or the TC have the following relation, U = Uq times q where Uq is the calibration constant of the QM or the TC. The electron beam from an electron synchrotron produced gamma ray due to bremsstrahlung, and the gamma ray irradiated the QM or the TC in a laboratory. The electron beam was monitored by a secondary electron monitor (SEM) which was calibrated with a Faraday cup (FC). The amount of charge integrated in the SEM, QM, TC, and FC was measured with Lewis and Collinge type current integrators. Two aluminum plates (597 u and 209 u thick) were used for the conversion of electrons to gamma ray. Author (NSA)

N71-34707# Tokyo Univ. (Japan). Inst. for Nuclear Study.
PDP-9 PROGRAMS FOR INS FM ANALYZER. 1: FMMASZ, FMMAEZ, FMMACZ, FMANLZ, AND FMMASQ
Jun Kokame 1 Dec. 1970 16 p In ENGLISH and JAPANESE
(INS-TL-107) Avail: AEC Depository Libraries

Programs for a PDP-9 computer to perform various experiments with a FM cyclotron beam analyzer are provided. These programs were used so widely and frequently that their function, constitution, usage, and contents are described for the purpose of providing reference for those who intend to use them or to develop new programs. The programs FMMASZ, FMMAEZ, FMMACZ, FMANLZ, and FMMASQ are described. Also, precautions for program loading and usage, constitution, flow charts, and contents of the programs are described. NSA

N71-34708# Tokyo Univ. (Japan). Inst. for Nuclear Study.
PDP-9 PROGRAMS FOR INS FM ANALYZER. 2: QVSPAC AND QVCSPA
Jun Kokame 1 Dec. 1970 11 p refs In JAPANESE
(INS-TL-108) Avail: AEC Depository Libraries

The programs QVSPAC and QVCSPA are written for a PDP-9 computer for computing the excitation energy of residual nuclei (QX value) corresponding to the peak value in the momentum spectrum measured with a 200-run proportional counter of a FM cyclotron analyzer. The programs can compute energy loss of incident and emitted particles in a target so that the Q value is calculated with correction for these effects. However, the programs can compute Q values only for those targets of simple substances or two-element compounds, and can neither handle more complex targets nor correct the energy loss within the backing. This is due to the limitation on memory capacity. The function, usage, contents and constitution of the programs are described. Flow charts and a typical FORTRAN program are shown as examples. NSA

N71-34709# Lyon Univ. (France). Institut de Physique Nucleaire.
THE INTERDIGITAL STRUCTURE: THEORETICAL INTERPRETATION TEST AND PRINCIPAL CONTROLS FOR PRACTICAL OPERATION
Michel Bres Feb. 1971 55 p refs In FRENCH
(LYCEN-7103) Avail: AEC Depository Libraries

The research was carried out in the framework of a project for a heavy ion accelerator reaching 10 MeV per nucleon. The phase shift in an interdigital structure of the H type was studied using a ladder model of filter sections. A good qualitative explanation of the phenomenon was obtained from a theoretical study. A device allowing the resonance frequency of the cavity to be varied was studied experimentally and theoretically. The device was used to vary the accelerating electric field. Author (NSA)

N71-34710# Japan Atomic Energy Research Inst., Tokyo.
GENERALIZATION OF EIKONAL APPROXIMATION
Hiroshi Ryufuku Nov. 1970 45 p In JAPANESE, ENGLISH summary
(JAERI-Memo-4195) Avail: AEC Depository Libraries

Calculations are carried out of scattering amplitudes, charge-exchange probabilites, and total cross sections for nuclei B incident on hydrogen-like atoms . In this method the transition matrices are calculated, using distorted waves instead of plane waves employed in the Born approximation as the initial state; also, the distortion of waves due to the static potential field made by the target atoms is taken into consideration. Results obtained for the charge-exchange process p + H(1s) yields H(1s) + p are presented. Author (NSA)

N71-34711# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
EQUIVALENT SAMPLE METHOD FOR ANALYZING OSCILLATION EXPERIMENTS ON FISSIONABLE SAMPLES IN A THERMAL NEUTRON REACTOR [METHODE DE L'ECHANTILLON EQUIVALENT POUR INTERPRETER LES EXPERIENCES D'OSCILLATIONS D'ECHANTILLONS FISSILES DANS UNE PILE A NEUTRONS THERMIQUES]
Bernard Laponche (Ph.D. Thesis - Paris Univ., Orsay) Mar. 1971 139 p refs In FRENCH
(CEA-R-4152) Avail: AEC Depository Libraries

In oscillation experiments, a standard fuel element of a critical experimental reactor was replaced by a sample of a material, the neutronic properties of which were to be found. An original method was developed and applied to fissionable materials: two signals resulting from the perturbation generated in the reactor were measured. One was the so-called Global signal, due to the change in reactivity, the other was the Local signal, due to the change in the reaction rate of a detector located near the sample. Neutronic properties were deduced from the signals with the aid of a double calibration with samples of known laws of absorption and production. The equvalent sample technique was used which is based on the definition of a fictitious sample, of known neutronic properties, with reaction rates of neutron absorption and production equal to those of the perturbing sample over a small area around the latter. The method was applied to the study of Pu-U alloys in graphite moderated lattices and results are presented.
Author (NSA)

N71-34712# Israel Atomic Energy Commission, Tel Aviv.
ESTIMATE OF THE ERROR BETWEEN B SUB (N PLUS 1) AND B SUB N APPROXIMATIONS
Y. Ronen Dec. 1970 12 p refs
(IA-1232) Avail: AEC Depository Libraries

The functional analysis method for error estimate is applied to estimate the error between the B sub (N+1) and B sub N approximations. The bound obtained is compared with the actual error for the case of B sub 1 and B sub 0 approximations.
Author (NSA)

N71-34713# Aerospace Corp., San Bernardino, Calif. Inst. Atomnoi Energii.
METHOD OF DIRECT MEASUREMENTS OF THE CAPTURE CROSS SECTION RATIO TO THE FISSION CROSS SECTION
G. V. Muradyan, T. A. Mostovaya, V. I. Mostovoi, and Yu. G. Shchepkin 1970 24 p refs In RUSSIAN
(IAE-1985) Avail: AEC Depository Libraries

The direct measurements of the capture cross section ratio to the fission cross section (alpha) are described. The fission events were recorded by means of ionization chamber. The layer of the studied substance was distributed along the neutron beam and served as the specimen for measuring the capture. Neutron capture was recorded by NaI(Tl) crystals. The magnitudes of alpha for U-235 were found in the neutron energy range from 0.3 to 5000eV. NSA

N71-34714# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
NEW TUNGSTEN ISOTOPES
E. Nadjakov, B. Bochev, Ts. Venkova et al 1971 18 p refs In RUSSIAN
(JINR-P6-5618) Avail: AEC Depository Libraries

In compound-nucleus reactions followed by neutron evaporation, neutron-deficient tungsten isotopes far from the stability region were produced by bombarding Gd-156 and Gd-516 Ne-22 and Ne-20 ions. The isotopes were identified according to the genetic relationships with the daughter isotopes of Hf and Ta. New isotopes of W-171 (9.0 + or - 1.5 min) and W-170 (4 + or - 1 min) were found. Author (NSA)

N71-34715# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronphysik und Reaktortechnik.
MONTE-CARLO METHOD FOR EVALUATION OF THE EFFICIENCY OF A BORON-NaI COUNTER [EIN MONTE-CARLO PROGRAMM ZUR BERECHNUNG DER ANSPRENCHWAHRSCHEINLICHKEIT EINES BOR-N AJ-ZAEHLERG]
Volker Brandl Dec. 1970 33 p refs In GERMAN; ENGLISH summary
(Proj. Schneller Brueter)
(KFK-1182) Avail: AEC Depository Libraries

A Monte-Carlo code for the evaluation of the efficiency of a B-NaI neutron counter is described. The counter detects the 478 KeV gammas from the sequence of reactions: B-10 + n = Li-7m + alpha + 2.3 MeV; Li-7m yields Li-7 + gamma + 478 KeV. Multiple elastic scattering of the neutrons on B-10 and (CH2)n is taken exactly into account by the code. For an arbitrary energy group of the neutrons the detector efficiency is, in principle, evaluated by an analog Monte-Carlo method. In all other energy groups the efficiency is simultaneously computed by the sampling of corresponding weights. The most important input data of the code are the geometry of the counter and the nuclear cross sections of its constituents. Author (NSA)

N71-34716# United Kingdom Atomic Energy Authority, Harwell (England).
PENA-DETECTOR FLUX MEASURING SYSTEM WITH A FAST RESPONSE
W. Johnstone Mar. 1971 19 p refs
(AERE-R-6732) Avail: AEC Depository Libraries

Primary-emission neutron-activated detectors are simple in construction, robust, capable of working at high temperatures, and do not require polarizing supplies. They have certain disadvantages, but these have now been overcome by introducing a compensating conductor and using a differential amplifier for current measurement by the availability of encapsulated FET-input amplifiers that have bias and drift currents several orders less than the lowest current likely to be measured, and by using an inverse-function amplifier to predict the final values of the slowly changing output of the current amplifier. The method employed to obtain the overall time constant of a complete system which is considerably shorter than the constituent parts is described. The method is given by which the resulting fast-response system was designed to accept a number of inputs, selected in turn, without saturating and latching up. Author (NSA)

N71-34717# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON POSSIBILITIES OF STUDYING THE STRUCTURE OF HIGHLY EXCITED STATES (RESONANCES) BY NEUTRON SPECTROSCOPY METHODS
V. G. Solov'ev 1971 28 p refs
(JINR-E4-5711) Avail: AEC Depository Libraries

The characteristics which are necessary for studying the structure of highly-excited nuclear states (resonances) are considered. It is shown that the possibilities of the time-of-flight techniques in neutron spectroscopy as applied to the study of the highly excited state structure become essentially richer if

unstable nuclei and isomers are used as the targets. The increase of the state density with excitation energy and the dependence of the density on the mass number are explained qualitatively. On the basis of the data on the reduced widths for the S-neutron capture and the E1 transitions to the low-lying states, the contribution of few-quasiparticle components to the excited-state wave functions is estimated. The problem of correlations between the reduced neutron and radiative widths is studied and some cases are indicated in which one can expect large correlations. The problem of correlations between gamma and (d,p) reactions is also considered. Author (NSA)

N71-34718# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
PARTICLE INTERFERENCE IN THE PROCESSES INVOLVING EXCITED NUCLEI
V. G. Grishin, G. I. Kopylov, and M. I. Podgoretskii 1971 18 p refs In RUSSIAN
(JINR-P1-5648) Avail: AEC Depository Libraries

The interference phenomena in nuclear reactions, proceeding through the intermediate isolated excited states, are described. The possibility of determination of the excited state width is discussed. Author (NSA)

N71-34719# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
POSSIBLE MEASUREMENT OF THE VELOCITY OF PROPAGATION OF GRAVITATIONAL INTERACTION
B. V. Vasilev 1971 7 p refs In RUSSIAN
(JINR-P13-5685) Avail: AEC Depository Libraries

The motion of a test body inside the system of oscillating masses in laboratory conditions is considered. It is shown that at the expense of the gravitational interaction with moving masses the test body acquires acceleration the magnitude of which can be sufficient for measuring the delay of the gravitational interaction and for determination of the velocity of gravitation propagation. Author (NSA)

N71-34720# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
RETARDED PART OF THE TWO TIME GREEN FUNCTION AND TWO BODY RELATIVISTIC PROBLEM
A. N. Kvinikhidze and D. Ts. Stoyanov 1971 17 p refs
(JINR-E2-5746) Avail: AEC Depository Libraries

It is shown that the retarded part of the two-time Green function is sufficient for the complete description of the two-body relativistic system. The quasipotential type equations are obtained for the relativistic scattering amplitude and wave function of two particles with arbitrary spins. Author (NSA)

N71-34721# Institute of Nuclear Research, Warsaw (Poland).
EIKONAL MODEL FOR HIGH ENERGY ELASTIC SCATTERING
Z. Rek 1970 26 p refs
(INR-P-1233) Avail: AEC Depository Libraries

The elastic processes proton proton, antiproton proton, pion (+) or (-) proton, and kaon (+) or (-) proton are investigated in terms of a model with Regge poles and cuts generated by multiple scattering. The Born term consists of the Pomeron and degenerate meson trajectories contributions. Predictions of the model are in reasonable agreement with the experimental data for total cross sections and the slope parameter of elastic differential cross sections in the energy range from 10 to 70 GeV. The slope of Pomeranchuk trajectory is found to be 0.4 (GeV/e) (-2). Some troubles of the present form of the model, connected with antishrinkage phenomenon and the shape of ReF/ImF in the forward direction, are discussed together with the possible generalization into the case of broken degeneracy. Some predictions are given about the asymptotic values of total cross sections and their behavior in the high energy region. Author (NSA)

N71-34722# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.
ON THE MANY BARYON RESONANCES
L. A. Kondratyuk and I. S. Shapiro 1970 32 p refs In RUSSIAN; ENGLISH summary
(NP-18779) Avail: AEC Depository Libraries

The quasi-nuclear model of many-baryon resonances, which results from Delta hyperon-N potential interaction, is formulated. The interaction Delta hyperon-N, decay modes and production mechanisms to two-and three-baryon resonances, involving the Delta hyperon isobar, are investigated. The experimental data on two-baryon resonances with isospin T = 1 are analyzed. Author (NSA)

N71-34723# Scientific Research Inst. of Electro-Physical Apparatus, Leningrad (USSR).
EFFECTS OF SYNCHROTRON RADIATION ON THE SLOW EJECTION OF ELECTRONS FROM SYNCHROTRON
B. S. Mingalev, Yu. P. Sivkov, and Kh. A. Simonyan 1970 39 p refs In RUSSIAN; ENGLISH summary
(NP-18780) Avail: AEC Depository Libraries

Problems are discussed concerning the slow ejection of electrons from a synchrotron with the help of a resonant swing of betatron oscillations on nonlinear perturbations of a magentic field. The influence of quantum functions of radiation of high energy electrons on the betatron oscillation swing is taken into account. Conclusions on the selection of optimal current pulse shapes in quadrupole and sextupole lenses, producing magnetic field perturbations are made. Author (NSA)

N71-34724# Clermont-Ferrand Univ. (France). Lab. de Physique Nucleaire Fondamentale et Development.
USE OF SEMICONDUCTOR TELESCOPES FOR DETECTING THE RECOIL NUCLEI IN PROTONLIGHT NUCLEUS COHERENT SCATTERING AT HIGH ENERGY [UTILISATION DETELESCOPES A SEMICONDUCTEURS POUR LA DETECTION DES NOYAUX DE RECUL DANS DES EXPERIENCES DE DIFFUSION COHERENTE PROTON-NOYAU LEGER A HAUTE ENERGIE]
M. Brossard, J. Combe, J. Fain, J. Gardes, L. Meritet et al Nov. 1970 15 p refs In FRENCH, ENGLISH summary Prepared in cooperation with Lyon Univ.
(LYCEN-7085) Avail: AEC Depository Libraries

The use of semiconductor telescopes in detecting and identifying recoil nuclei in coherent proton-nucleus interactions at 600 MeV is described. Preliminary results obtained with gaseous He-3 and He-4 targets at a pressure of one atmosphere are presented. A mean precision of 1% was obtained for the four-momentum transfer involved in the elastic interaction. Author (NSA)

N71-34725# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
CONSTRUCTION OF NON-LOCAL QUANTUM ELECTRODYNAMICS
G. V. Efimov 1971 30 p refs In RUSSIAN
(JINR-P2-5694-E) Avail: AEC Depository Libraries

The perturbation theory of electromagnetic interactions is considered. A hypothesis is proposed that the electromagnetic potential is connected with the local fermion current by a nonlocal form-factor, where K(x-y) is a nonlocal distribution and its Fourier transform is an entire analytical function. The intermediate regularization gage invariant when regularization is moved off. The interaction Lagrangian maintains no infinite counter terms. Author (NSA)

N71-34726# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
QUANTUM FIELD THEORY WITH NON-EUCLIDEAN OF THE BOUND SYSTEM
V. G. Kadyshevskii 1971 21 p refs In RUSSIAN Submitted

for publication
(JINR-P2-5717) Avail: AEC Depository Libraries

An explicitly relativistic invariant three-dimensional formulation of the quasipotential method of Logunov and Tavkhelidze for the system of two particles with arbitrary spins and masses is given. This formalism is used to consider the matrix elements of local operators between the bound states (the form factors of the bound system). The transformation law of the three-dimensional wave functions in the transition from the center of mass system to an arbitrary reference frame is obtained.
Author (NSA)

N71-34727# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
TIMOC: A GENERAL PURPOSE MONTE CARLO CODE FOR STATIONARY AND TIME DEPENDENT NEUTRON TRANSPORT
H. Kschwendt and H. Rief 16 Jun. 1970 236 p refs
(EUR-4519-E) Avail: AEC Depository Libraries

TIMOC is a Monte Carlo code for the solution of the energy and time dependent (or stationary) neutron transport equation in 3-dimensional geometries. It is written in FORTRAN 2 and FAP and can be operated on the IBM 7090/95. The program can treat all commonly used scattering kernels, such as: isotropic and anisotropic elastic scattering, level excitation, the evaporation model, the energy transfer matrix model, which includes (n,2n) reactions, absorption and fission. After each collision process the neutron history gets assigned a discrete energy value. The nuclear data input is, however, done by group averaged cross sections, which can be generated for any desired group structure from the ENDF/B library using the CODAC code. The geometry routines of TIMOC are exchangeable. TIMOC can generate the neutron fluxes either resulting from an external source or their fundamental mode distribution by a special source iteration procedure in eigenvalue problems. Author (NSA)

N71-34728# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
COHERENT FREQUENCIES OF TRANSVERSE OSCILLATIONS IN THE ELECTRON MODEL OF A RING CYCLOTRON
V. A. Kochkin, D. L. Novikov, and L. M. Onishchenko 1971 p refs In RUSSIAN
(JINR-P9-5677) Avail: AEC Depository Libraries

The calculated values of the frequencies of transverse oscillations in the beam center are presented for several variants of a magnetic field as well as the results of experimental determination of these frequencies by the resonance knockout method.
Author (NSA)

N71-34729# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
DATA ON ENVIRONMENTAL RADIOACTIVITY COLLECTED IN ITALY, JULY - DECEMBER 1968
Dec. 1969 176 p refs
(PROT-SAN-13169) Avail: AEC Depository Libraries

Results are reported from fallout monitoring programs in Italy from July to December, 1968. Data are included on the gross beta activity in samples of atmosphere, surface waters, and drinking water supplies, and the content of Cs-137 and Sr-90 in samples of cheese, milk, and vegetables, and the content of Sr-90 in drinking water. Results of radiation monitoring studies in the environs of nuclear power stations and nuclear research centers are included.
NSA

N71-34730# Commissariat a l'Energie Atomique, Chuscian (France). Centre de Production de Plutonium de Marcoule.
NUCLEAR ENERGY: ACCIDENTS AND INCIDENTS [L'ENERGIE NUCLEAIRE ACCIDENTS ET INCIDENTS]
Yves Sutra-Fourcade Oct. 1969 154 p refs In FRENCH
(CEA-Bib-184) Avail: AEC Depository Libraries

The known incidents and accidents which occurred in nuclear installations up to 1968 are listed. Incidents occurring during transport of radioactive materials in hospitals or private establishments and incidents which in different ways involved radioactive materials (nuclear submarines, bombers carrying nuclear warheads, bomb tests, etc.) are included. Six categories of incidents have been considered: (1) critical incidents and power excursions of critical assemblies, nuclear reactors, and chemical processing installations; (2) can rupture in nuclear reactors; (3) various incidents in nuclear reactors; (4) incidents during transport of radioactive materials; (5) incidents during testing of nuclear devices; and (6) other incidents. Author (NSA)

N71-34731# European Organization for Nuclear Research, Geneva (Switzerland).
CATALOGUE OF REPRINTS OF SCIENTIFIC PAPERS IN THE PAULI COLLECTION
1969 407 p refs
(CERN-Bib-8) Avail: AEC Depository Libraries

This catalogue lists all the reprints in Pauli's collection. His own filing order has been conserved and all reprints are numbered in this sequence (10644). Each reprint is filed under the name of one of its authors and cross references are given for all co-authors.
NSA

N71-34732# Australian National Univ., Canberra. Research School of Physical Sciences.
FIDEL: AN OPTICAL MODEL SEARCH CODE WITH SPIN ORBIT TERMS FOR SPIN-1/2 AND SPIN-1 PARTICLES
D. M. Rosalky [1970] 11 p refs
(ANU-P-500) Avail: AEC Depository Libraries

An optical-model search code, which includes spin-orbit terms in the scattering and absorption potentials, for spin-1/2 and spin-1 particles was developed for use on the IBM 360/50. The optical-model computation is performed by modified sections of the DWBA code DWUCK. A value of X2 is calculated in terms of experimental and calculated values of the differential cross section and the vector polarization and is minimized with respect to specified parameters by subroutine FITTEM.
Author (NSA)

N71-34733# Australian National Univ., Canberra. Dept. of Nuclear Physics.
HAUSER: A COMPUTER CODE FOR THE CALCULATION OF COMPOUND NUCLEUS CROSS SECTIONS USING THE HAUSER-FESHBACH THEORY
P. J. Dallimore [1970] 20 p refs
(ANU-P-512) Avail: AEC Depository Libraries

A computer code which calculates compound nucleus cross sections using the theory of Hauser and Feshbach was developed for use on the IBM 360/50 computer. The program incorporates a level-density description of all possible exit channels and includes the width-fluctuation correction factor.
Author (NSA)

N71-34734# Centre de Recherches Nucleaires, Strasbourg (France). Centre de Recherches Nucleaires.
OBSERVATION OF THE d STAR EFFECT IN THE ANTIPROTON DEUTERON YIELDS PROTON ANTIPROTON ON PION(PLUS) PION(MINUS) NEUTRON REACTION AT 5.55 GeV/c
H. Braun, D. Evrard, A. Fridman, J.-P. Gerber, R. Kahn et al [1971] 11 p refs
(NP-18796) Avail: AEC Depository Libraries

This experiment is based on 150,000 photographs, taken at the ZGS with the 30 inch bubble chamber. Results are presented from a subsample of spectator proton antiproton pion (+) neutron events in which the protons stopping in the chamber do not exhibit the characteristic nucleon spectator behavior. The selection procedure for this sample is discussed. A strong low mass spectator proton neutron pion (+) enhancement at 2.2 GeV/c2 deuteron pion enhancement, observed, for instance in the antiproton deuteron yields antiproton deuteron pion(+) pion(-) reaction at the same energy.
NSA

N71-34735# National Research Council of Canada, Ottawa (Ontario).
EXCITATION OF Rb(PLUS) IN Kr MATRIX BY A SUDDEN CHANGE OF THE CENTRAL FIELD DUE TO BETA DECAY OF Kr 85 [DIE ANREGUNG VON RB(PLUS) IN EINEM KRYPTONGITTER DURCH DIE PLOETZLICHE ZENTRAL FELDAENDERUNG BEIM BETA-ZERFALL VON KR 85]
Hans Micklitz 1971 28 p refs Transl. into ENGLISH from Z. Physik (West Germany), v. 215, 1968 p 302-322
(NRC-TT-1461) Avail: NTIS

After the beta decay of Kr-85 in solid krypton, the Rb(+) ion resulting from this decay is excited in 4p5 5p (J=0) states with a certain probability. The photon spectrum, due to dipole transitions from these excited states, selected with narrow band filters and measured in coincidence with the emitted beta particles, shows narrow bands (lines) and broadbands. The lines are not shifted with respect to the atomic Rb(+) lines, whereas each broadband can be interpreted as a component of each line, being shifted about 800 cm/1 to the blue end of the spectrum. A magnitude calculation of the spectral shift and the excitation probability with the LCAO approximation is made. Author

N71-34736# National Research Council of Canada, Ottawa (Ontario).
EXCITATION OF BOUND ATOMIC STATES BY A SUDDEN CHANGE OF CENTRAL FIELD RESULTING FROM NEGATIVE BETA DECAY [ANREGUNG GEBUNDENER ATOMZUSTAENDE DURCH DIE PLOETZLICHE ZENTRALFELDAENDERUNG BEIM NEGATIVE BETA-ZERFALL DES KERNS]
H. Juergen Andrae 1971 29 p refs Transl. into ENGLISH from Z. Physik (West Germany), v. 215, 1968 p 279-301
(NRC-TT-1455) Avail: NTIS

By the sudden change of nuclear charge during beta-decay the daughter ion is ionized or excited with probabilities of the order of some percent; other processes in the electron shell may be neglected, therefore unperturbed excitations can be measured by detecting photons emitted from the decaying excited atomic states in delayed coincidence with beta-particles. More extensive measurements of the photon emission after this decay give results in good agreement with theoretical predictions. Mostly such photons are observed, which can be emitted after a monopole-excitation, for which the selection rules delta J=0 and delta Z=0 are valid. The total excitation probability into both 5p(J=0)-states of Rb 2 is found to be P(4p-5p)=5.61.0%. The lifetimes of these two states are measured. Author

N71-34737# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
TWO PARTICLE-TWO HOLE MIXING IN HARTREE-FOCK CALCULATIONS
J. A. Rabbat and G. Do Dang Apr. 1971 9 p refs
(LPTHE 71/18) Avail: NTIS

The constrained Hartree-Fock theory is used for studying the stability of the solutions against two particle-two hole excitatations. Quadrupole and hexadecapole deformations are imposed on the Hartree-Fock equations to get the true energy minimum and the equilibrium shape. Energy corrections are calculated using second-order perturbations and complete diagonalization. Applications are made to the Ne-20 and Si-28 nuclei. Author

N71-34738# Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warsaw (Poland).
NUKLEONIKA
Szymon Suckewer et al 1970 132 p refs Transl. into ENGLISH of Nukleonika (Poland), v. 15, no. 1, 1970 p 1-144
(AEC-Tr-7102/1; UC-34; TT-70-55010/1) Avail: NTIS

Results of ion and electron temperature measurements for the focusing rod plasma injector are given for different initial conditions. The ion temperature measurements were performed with plasma being observed lengthwise and perpendicularly to the gun axis, to eliminate the influence of the correlated axial motion of plasma. It was found that T sub I increases with rise in ion charge, whereas increasing the initial gas pressure in the discharge tube the ion temperature decreases. The ion temperature drop is also observed when applying external magnetic field H sub z = 5 kGs. The highest value of T sub I = 1.5 million K is found for the air initial pressure p = 0.0001 torr, whereas maximum electron temperatures do not exceed T sub e = 50,000 K. The ion and the electron temperature are determined as functions of the distance from the gun axis. Considerable differences observed between the electron and the ion temperatures are also discussed. Author

N71-34739# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
THEORETICAL PHONON PHYSICS Progress Report, 1 Apr. 1970 - 31 Mar. 1971
J. A. Krumhansl 31 Mar. 1971 12 p refs
(Contract AT(30-1)-3699)
(NYO-3699-53) Avail: NTIS

Phonon research on crystals and liquids is briefly reported. Among the topics investigated are the following: highly anharmonic crystals of He-3, He-4, He2, and Ne; theoretical models for excitations in disordered, systems, disorder-broadened band structure of SiGe, structural phase transformations in solid and liquid metals and alloys, and specific heat of disordered materials; effect of isotope substitutions on frequency resonant modes, and Raman scattering with incident radiation near resonance with an electronic transition; phonon hydrodynamics in crystals; and computer studies of liquids. N.E.N.

N71-34740# Washington Univ., Seattle.
BREIT-WIGNERS VIEWED THROUGH GAUSSIANS
D. H. Wilkinson (Nuclear Phys. Lab., Oxford, England) 1971 p ref Sponsored by AEC
(RLO-1388-135) Avail: NTIS

The frequently-occurring situation is analyzed in which a signal of Breit-Wigner form, as, for example, a particle group from a state in the continuum of an excited nucleus, is detected by a measuring instrument whose resolution function may be represented by a Gaussian, such as a solid-state detector, so that the observed signal is a convolution of the Breit-Wigner and the Gaussian. Tabular, graphical, and analytical answers are given to the questions: What is the form of the convoluted signal? By how much is the peak height lowered by the convolution? How is the Breit-Wigner width Gamma to be extracted? What fraction of the area under the convoluted peak lies outside given limits? Author (NSA)

N71-34741# Oak Ridge National Lab., Tenn. Medical Instrumentation Group.
PHANTOM FOR THE ADJUSTMENT OF GAMMA-RAY IMAGING DEVICES
P. R. Bell and D. A. Ross May 1971 7 p Supported in part by NIH
(Contract W-7405-eng-26)
(ORNL-TM-3281) Avail: NTIS

A test target (phantom) is described which, when properly loaded with a radionuclide in solution, can be used to assess the performance of a moving-detector scanner or a gamma camera. Since scattered radiation often degrades the quality of the picture delivered by an improperly operated instrument, the phantom intentionally presents a scattering problem as well as problems of target resolution. It also provides special tests for tomographic scanners. Instructions for assembly and loading are given. Author (NSA)

N71-34742# Oak Ridge National Lab., Tenn.
MOUND ASSISTANCE PROGRAM: DEVELOPMENT OF A SOL-GEL PROCESS AND EQUIPMENT FOR THE PRODUCTION OF DENSE Pu(238)O2 MICROSPHERES
F. G. Kitts, R. E. Brooksbank, R. G. Haire, and M. H. Lloyd Mar.

1971 112 p refs
(Contract W-7405-eng-26)
(ORNL-4565) Avail: NTIS

Microspheres of Pu-238O2, a potentially important isotopic power source, have been produced in kilogram quantities using a plasma torch. The feasibility of producing Pu-238O2 microspheres by the sol-gel process was investigated. The sol-gel process offers important advantages from the standpoints of product quality, process simplicity, and overall safety. It was found that satisfactory Pu-238O2 flowsheet, if the feed was carefully prepared and a simple aging step was included. A remotely operated, neutron-shielded facility was constructed to process 200 g of plutonium per day. Successful demonstrations with Pu-239 were carried out in this facility and, although those with Pu-238 were less satisfactory, valuable experience was gained in preparing Pu-238O2 sol by remote means. It was concluded that Pu-238O2 sols and high-quality microspheres could be produced in the quantities required. Author (NSA)

N71-34743# Oak Ridge National Lab., Tenn.
COLLISIONAL IONIZATION BETWEEN CESIUM AND SELECTED MOLECULES
S. J. Nalley (Ph.D. Thesis - Tenn. Univ.), R. N. Compton, H. C. Schweinler, and P. W. Reinhardt Apr. 1971 126 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2620) Avail: NTIS

An apparatus was designed and assembled, and a method was developed for the observation of low-energy neutral atom-molecule collisions in the greater-than-thermal energy range. Included in this apparatus were a fast-atom beam source, which utilized the resonance charge-transfer principle to produce a neutral Cs beam from a positive Cs ion beam, a detector for determining the energy of the beam, and a time-of-flight mass spectrometer for identifying the reaction products. The method consisted of directing a neutral Cs beam onto a target gas in the reaction region of a time-of-flight mass spectrometer and identifying the resultant negative ions from their mass-to-charge ratio. An investigation was then made of the reactants, neutral Cs plus NO2 or N2O or O2, to determine the energies at which the negative ions first appeared. A comparison was made with the theory of the behavior of the relative cross sections for the production of NO2, N2O, and O2 negative ions in a collision of neutral Cs atoms with the parent molecules at energies near threshold. Author (NSA)

N71-34744# Brookhaven National Lab., Upton, N.Y.
SINGLE-PARTICLE STATES OF DEFORMED TRANSURANIUM NUCLEI IN THE SAXON-WOODS POTENTIAL
F. A. Gareev et al Mar. 1971 25 p refs Transl. into ENGLISH from Russian report JINR-P4-5221 Sponsored by AEC
(BNL-TR-416; JINR-P4-5221) Avail: NTIS

An approximation method for solving Schroedinger's equation by means of the Saxon-Woods potential for spherical and deformed nuclei was successfully applied to describe the properties of nuclei in the rare earth region. The method is precise and retains the advantages of Nilsson's approximation while overcoming its shortcomings. This one particle level scheme is presented for nuclei in the transuranium region by calculating the levels of the A = 239 nucleus. The order of filling of the ground states was not sufficiently well indicated by the scheme; however, introduction of a hexagonal deformation resulted in a satisfactory one particle scheme for odd transuranium nuclei. NSA

N71-34745# General Electric Co., Schenectady, N.Y. Knolls Atomic Power Lab.
NEUTRON THERMALIZATION IN H2O AT 318 K AND 77 K
S. N. Ishmaev (Inst. Atomnoi Energii, Moscow) et al Mar. 1971 29 p refs Transl. into ENGLISH from IAE-1954 report Sponsored by AEC
(KAPL-Trans-4; IAE-1954) Avail: NTIS

The process of neutron thermalization with time in water and in ice was investigated experimentally by measuring the neutron flux time dependence at several fixed energies. It is shown that the probe tube for extracting the neutron beam from the water system significantly distorts the measured results. The perturbation effect of the hole is the basic reason for the discrepancy with the theory. The experimental results obtained for water are in complete agreement with previous theoretical calculations based on the Nelkin model for H2O. Analysis of the experimental results permitted one to determine in water and in ice the zeroth and the first discrete eigenvalue of the time-dependent Boltzmann equation scattering operator. The following values of the neutron thermalization time in water were obtained: 5.8 0.6 microsecond at T = 318 K and 55.5 1.5 microsecond at T = 77 K. Author (NSA)

N71-34746# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
STUDY OF THE SPONTANEOUS FISSION OF Cf 252
V. P. Zakharova, V. A. Korostylev, and D. K. Ryazanov 1970 9 p refs
(ORNL-TR-2463; IAE-2036) Avail: NTIS

The distributions of the total kinetic energy of the fission products of Cf-252 are given as a function of the ratio of the fission product masses (R). A double ionization chamber with a grid was used in measuring the energy. The spectra of the total kinetic energy of the fission fragments corresponding to the symmetrical (R approximately 1) and strongly asymmetrical (R approximately 2) regions loses the form of a single-peak Gaussian distribution. Possible reasons for this phenomenon are discussed. Author (NSA)

N71-34747# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
DESIGN AND FABRICATION OF A PORTABLE DEVICE FOR NEUTRON RADIOGRAPHY
J. L. Cason Mar. 1971 50 p
(Contract AT(45-1)-1830)
(BNWL-1329) Avail: NTIS

Research is being conducted to determine the usefulness of Cf-252 as a source for portable thermal neutron radiography. Emphasis has been in developing a device using Cf-252 that could be used for laboratory, hot cell, or field having a neutron yield of 10 to the 8th power was used in an experimental container designed for neutron radiography. A first generation portable device which completely contains the Cf-252 has been designed and built and is presently being evaluated. Preliminary work included flux measurements and neutron radiographs. The neutron camera is completely portable and can be used in the laboratory, hot cell, or field. The shielding characteristics are such that it can be transported by common carrier. Author (NSA)

N71-34748# California Univ., Berkeley. Lawrence Radiation Lab.
ENERGY CONTINUATION OF AN ENERGY-INDEPENDENT PION-NUCLEON PHASE-SHIFT ANALYSIS FROM 385 TO 1700 MeV/c
R. D. Field, Jr. 10 Feb. 1971 57 p refs
(Contract W-7405-eng-48)
(UCRL-20250) Avail: NTIS

Starting from an energy-independent phase-shift analysis carried out at 26 moments between 385 and 1700 MeV/c, an attempt is made to find the proper energy continuation through these moments. Several path-finding schemes are compared which are designed to take into consideration both the continuity and the smoothness of the partial-wave amplitudes as viewed on an Argand diagram. While differing in detail, the various methods yield essentially the same results for the important partial waves. These results agree in general with paths found by other methods, but contain some evidence for additional resonances between 1500 and 1700 MeV. Author (NSA)

N71-34749# Atomic Energy Commission, Washington, D.C. Div. of Research.
PROGRESS IN CONTROLLED THERMONUCLEAR RESEARCH
R. W. Gould, H. P. Furth, R. F. Post, and F. L. Ribe Dec. 1970 101 p refs
(WASH-1172) Avail: SOD $1.00

Progress of controlled fusion research is discussed in relation to the following areas: (1) magnetic mirror systems, (2) steady-state toroidal systems, (3) Astron, (4) pulsed high-beta systems, and (5) engineering and environmental aspects of fusion reactors. NSA

N71-34750# Chicago Univ., Ill. Enrico Fermi Inst.
ANALYSIS OF SPIN CORRELATIONS IN THE BETA DECAY OF THE LAMBDA HYPERON
Augusto Garcia Dec. 1970 54 p refs
(Contract AT(11-1)-264)
(COO-264-569; EFI-70-75) Avail: NTIS

Integrated expressions for the measured quantities in terms of form factors are given up to second order. The sensitivity of these experimental quantities as functions of specific form factors is studied, and it is exhibited in a form which is useful for the analysis of present experiments and for the planning of future ones. Within the framework of V-A theory, the possibility is explored that the data require the presence of an induced pseudo-tensor form factor. Qualitative discussions of the q squared dependence of some form factors and of possible admixtures of scalar and tensor interactions are also given. Author (NSA)

N71-34751# State Univ. of New York, Stony Brook. Dept. of Physics.
BUBBLE CHAMBER GROUP Progress Report, 1 Jan. - 3 Dec. 1970
1971 51 p
(Contract AT(30-1)-3668A)
(NYO-3668-TA-5) Avail: NTIS

A series of measurements on hyperon leptonic decay was completed; a three year comprehensive study of a half million pictures in search for rare decay modes was finished. The measurements include the partial decay rate of the Lambda hyperon decaying into muon, proton, and antineutrino, and the partial decay rate for the Lambda hyperon decaying into electron, proton, and antineutrino. In high energy interactions, the pion multiplicity and two prong events in an exposure of 8.5 GeV/c pion(+) on hydrogen were measured. The two prong data were used in conjunction wth different topologies to obtain single particle momentum distributions in the final state. Author (NSA)

N71-34752# Chicago Univ., Ill.
COMPLEX NEGATIVE SIGNATURE TRAJECTORIES AND THE POMERANCHUK THEOREM
Reinhard Oehme Jan. 1971 14 p refs
(Contract AT(11-1)-264)
(COO-264-571; FFI-71-3) Avail: NTIS

Within the framework of complex angular momentum methods, it is shown that amplitudes which violate the Pomeranchuk theorem requires negative signature trajectories which are of the form alpha(t) = 1 + or - const. square root of t + O(t) near t = 0. There must be corresponding positive signature trajectories. The character of the singular surfaces with negative signature is discussed briefly. Author (NSA)

N71-34753# State Univ. of New York, Stony Brook. Dept. of Physics.
TRITON CALCULATIONS WITH REALISTIC POTENTIALS IN A HARMONIC OSCILLATOR BASIS
A. D. Jackson [1970] 8 p refs Sponsored in part by AEC
(NYO-4032-36) Avail: NTIS

Previous techniques using the Reid soft-core potential are used to calculate the binding energy and ground-state wave function of the triton with a relativistic nucleon-nucleon interaction. As an indication that a harmonic oscillator is capable of dealing with such realistic potentials, calculations of deuteron properties for the Reid potential are also performed. NSA

N71-34754# Columbia Univ., New York. Dept. of Physics.
METHOD FOR COMPUTING SCATTERING MATRIX ELEMENTS IN A CLASS OF NON-RENORMALIZABLE FIELD THEORIES
N. H. Christ [1971] 11 p refs Presented at Conf. on Fundamental Interactions at High Energy, Coral Gables, Fla., 20 Jan. 1971 Sponsored by AEC
(NYO-1932(2)-192; Conf-710106-B) Avail: NTIS

A method is discussed which is applicable to a class of nonrenormalizable field theories in which the nonrenormalizable coupling can be written in an exponential form. A theory is considered containing two scalar particles whose interactions are described by the Lagrangian density. NSA

N71-34755# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
DIRECT OBSERVATION OF LONG RANGE MIGRATION OF SELF-INTERSTITIAL ATOMS IN STAGE 1 OF IRRADIATED PLATINUM
P. Petroff and D. N. Seidman 2 Mar. 1971 9 p refs
(Contract AT(30-1)-3504)
(NYO-3504-57; Rept-1529) Avail: NTIS

The motion of single self-interstitial atoms (SIAs) in Stage I of irradiated platinum was observed directly by field-ion microscopy. A specimen irradiated at a temperature of 10 K with 20keVPt(+) ions was found to contain immobile SIAs in the bulk at this temperature, as determined via pulse-field evaporation experiments. Direct observation of specimens, irradiated with 20or 30-keVPt(+) ions, during warming experiments from 10 to 70 K, showed that a flux of SIAs crossed the surface of the specimens between 13 and 25 K. Application of a diffusion model to the data yielded a value of approximately 0.06 eV for the enthalpy change of migration and a diffusion coefficient of approximately 0.5 exp(-0.06eV/kT)cm sq/sec for the SIA. Author (NSA)

N71-34756# Syracuse Univ., N.Y. Dept. of Physics.
INEQUALITIES FOR THE PION PION PARTIAL WAVES FROM THE PROPERTIES OF A CLASS OF ORTHOGONAL POLYNOMIALS
A. P. Balachandran and Maurice L. Blackmon Jan. 1971 38 p refs Sponsored by AEC
(SU-1206-240; NYO-3399-240) Avail: NTIS

The pion pion partial-wave amplitudes are the projections of the corresponding scattering amplitudes with respect to the Legendre polynomials with appropriate arguments. In the past few years, several inequalities for the pion pion partial-wave amplitudes have been obtained by using analyticity and unitarity. It is shown that many of these inequalities may be generalized into inequalities for the projections of the pion pion scattering amplitudes with respect to suitable classes of orthogonal polynomials. The generalization yields several new inequalities for the pion pion partial waves in the region 0> or = s > or = 4 sq m sub pi. In particular, such inequalities involving only s- p- and d-waves are derived. Author NSA

N71-34757# Chicago Univ., Ill.
LEPTONIC DECAY EXPERIMENTS WITH HYPERONS BEAMS AT NAL
Roland Winston [1970] 6 p refs Sponsored by AEC
(COO-1701-12) Avail: NTIS

The feasibility and physics of experiments on leptonic decay using hyperon beams is discussed quantitatively. It is assumed that the hyperons in the beam are unpolarized so that only decays with Lambda hyperons in the final state contain polarization information. The beta decays of unpolarized hyperons, decays with Lambda hyperons in the final state,

decays with muons in the final state, and selected possible experiments are considered. NSA

N71-34758# Minnesota Univ., Minneapolis. Tate Lab. of Physics.
NUCLEAR ORIENTATION OF Pr 142 IN PRASEODYMIUM METAL
C. H. Smith and W. Weyhmann Feb. 1971 73 p refs
(Contract AT(11-1)-1569)
(COO-1569-76) Avail: NTIS

The anisotropy of gamma radiation emitted by Pr-142 nuclei in polycrystalline praseodymium was measured in applied fields up to 41.7 kOe and temperatures down to 12 millidegrees K. The observed served anisotropies were fitted to a model in which an appropriate powder average was taken of the electronic moments measured by Lebech and Rainford by neutron diffraction from a single crystal of praseodymium in applied fields. The Van Vleck moments calculated from the crystal field eigenfunctions and energy splittings of Bleaney do not provide a large enough internal field to cause the observed anisotropies. In order to explain the large orientation observed, the first-forbidden beta decay of Pr-142 must be assumed to be almost pure Fermi with zero units of angular momentum usually carried away by the beta-neutrino pair. Author (NSA)

N71-34759# Oak Ridge National Lab., Tenn.
RADIATION OUTPUT DESCRIPTION FROM THE T(d,n) He- 4 REACTION IN A LARGE TARGET (1000 sq cm): OPERATION HENRE
Z. G. Burson Jul. 1970 72 p refs Sponsored by AEC
(CEX-65.05) Avail: NTIS

A description is given of the radiation output from the target substrate which was made of 2.54-cm thick copper, 40 cm in diameter and weighing 20,850 g. A depression 1.83 cm deep in the center of this plate provided a 37.5-cm diameter flat area for the deposition of a 1000 sq cm ErT2 film. A deuterium beam of 400 ma at 150 kV produced 10 to the 13th power neutrons/sec over 4 pi. Calculations of the energy and angular distribution of neutrons emerging from the target showed that in the straight down direction, 80 percent of the neutrons were in the 13- to 15-MeV region, 5 percent were in the 5- to 13-MeV region, and 15 percent were in the 0-to 5-MeV region. At 88 deg., the percentages were 67, 22.5, and 10.5, respectively. The calculated angular distribution of the 13- to 15-MeV component compare well with activation-foil data. Forty-seven different trial spectra were chosen to evaluate the sensitivity of the foils to spectral changes. Author

N71-34760# Scientific Translation Service, Ann Arbor, Mich.
ABSORPTION OSCILLOGRAM OF CO2(PLUS)(X 2Pi g) AND N2(PLUS)(X 2 SIGMA g PLUS) IONS IN THEIR GROUND STATE PRODUCED BY PULSED RADIOLYSIS OF CO2 AND N2
Michel Clerc (CEN, Saclay, France) and Bernard Lesigne (CEN, Saclay, France) May 1971 6 p refs Transl. into ENGLISH from J. Chim. Phys. (France), v. 67, no. 4, 1970 p 701-703 Sponsored by AEC Prepared for Argonne Natl. Lab., Ill.
(ANL-Trans-881) Avail: NTIS

Kinetics of the CO2(+) and N2(+) emissions and absorptions of the CO2(+)(A 2 pi u to X 2 pi g) and N2(+)(B 2 Sigma u + to X 2 Sigma g +) transitions were recorded with a time resolution of the order 20 nsec by pulsed radiolysis. The order of magnitude of the rate of recombination, extinction coefficient, and temperature of CO2(+) are discussed. Author (NSA)

N71-34761# Los Alamos Scientific Lab., N. Mex.
NUCLEAR SAFEGUARDS RESEARCH AND DEVELOPMENT PROGRAM Status Report, Sep. - Dec. 1970
Jan. 1971 47 p refs
(Contract W-7405-eng-36)
(LA-4605) Avail: NTIS

Research and development results are reported on neutron interrogation and nondestructive assay of fissionable materials, passive neutron and gamma radiation uses, detector and instrumentation development, analytical and computational methods, mobile nondestructive assay laboratories, and Van de Graaff accelerator facility modification. Author (NSA)

N71-34762# Institute for Perception RVO-TNO, Soesterberg (Netherlands).
NUCLEAR RADIATION EFFECTS ON ELECTRONIC COMPONENTS AND APPARATUS: A BIBLIOGRAPHY, JANUARY 1967 - JANUARY 1970
P. J. Jeuken, comp. Nov. 1970 204 p refs
(TDCK-56709) Avail: NTIS

An annotated bibliography on nuclear radiation effects on electronic components is presented. Topics covered include: radiation effects on nonsemiconductor materials and components, radiation effects on semiconductor materials and devices, reliability and radiation hardening, and radiation model studies. Author

N71-34763# Northeastern Univ., Boston, Mass.
STATISTICAL SIGNIFICANCE OF A2 SPLITTING EXPERIMENTS
M. Gettner Aug. 1971 8 p refs Submitted for publication
(Grants NSF GP-9217; NSF GP-28307)
(NUB-2092) Avail: NTIS

A method is proposed for evaluating the intrinsic ability of any experiment to distinguish between the Breit-Wigner and dipole mass distributions. A figure of merit depending on the mass resolution, signal to noise ratio, and the number of events can be determined for an experiment. This figure of merit is a measure of the susceptibility of the experiment to statistical fluctuation. In addition, the relative importance of mass resolution, signal-to-background ratio, and statistics can be determined. The A2 experimental situation is evaluated and of the experiments discussed it is found only a few are intrinsically capable of distinguishing between a Breit-Wigner and a dipole. Author

N71-34764# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information.
POWER FROM RADIOISOTOPES
William R. Corliss and Robert L. Mead 1971 81 p refs
Avail: NTIS

Isotopic SNAP generator systems are discussed including basic principles, applications of various systems in space and on earth, and their scientific background. J.M.

N71-34765# Argonne National Lab., Ill.
MEASUREMENT OF THE RADIATIVE LIFETIMES OF CO2(PLUS) (A 2 Pi u), CO2(PLUS) (B 2 SIGMA u PLUS), CH(A 2 DELTA) AND CO(C 1 SIGMA PLUS) BY PULSED RADIOLYSIS [MESURES DES DUREES DE VIE RADIATIVES DE CO2(PLUS) (A 2 PI U), CO2(PLUS) (B 2 SIGMA U PLUS), CH(A 2 DELTA) AND CO(C 1 SIGMA PLUS) PAR RADIOLYSE PULSEE]
J. Le Calve et al [1971] 8 p refs Transl. into English from J. Phys. (Paris), v. 30, 1969 p 807-810
(ANL-Trans-879) Avail: NTIS

Gas-phase pulsed radiolysis of CO2, CH4, and CO, using a 600 keV, 10 joule pulsed electron source, enabled measurement of the radiative lifetime of excited states. The results obtained are CO2(+) (A 2 Pi u) = 147 + or - 10 nsec, CO2(+) (B2 Sigma u +) + or - 10 nsec, CH(A2 Delta) = 800 + or - 100 nsec, and CO(C 1 Sigma +) = 50 10 nsec. Author (NSA)

N71-34766# Oak Ridge National Lab., Tenn.
APPLICATION OF VARIATIONAL SYNTHESIS TO SOLUTIONS OF MULTIDIMENSIONAL NEUTRON TRANSPORT PROBLEMS

William Ronald Cobb (Ph.D. Thesis - Georgia Inst. of Tech.) Apr. 1971 156 p refs
(Contract W-7405-eng-26)
(ORNL-TM-3200) Avail: NTIS

The variational synthesis method was applied to the steady-state Boltzmann neutron transport equation in two- and three-dimensional rectangular geometry. In this application the energy dependence was treated in the standard multigroup energy approximation, the dependence along all but a single remaining spatial variable was treated by a multichannel discontinuous spatial synthesis approximation and the angular dependence was treated by a discrete ordinate approximation. All approximate treatments of these variables were developed consistently from a variational principle by the standard trial function reduction procedure, applied sequentially to the energy variable, the spatial variables, and the angular variable. The approximate method as developed in this application allows the user to obtain approximate solutions to the transport equation by combination of the solutions to related problems of lower dimensionality. Author (NSA)

N71-34767# Oak Ridge National Lab., Tenn.
MONTE CARLO PROGRAM FOR PHOTON AND ELECTRON TRANSPORT
Haruo Sugiyama 1970 25 p refs Transl. into ENGLISH from Denki Shikensho Iho (Japan), v. 34, 1970 p 126-140 Sponsored by AEC
(ORNL-TR-2464) Avail: NTIS

A general method of Monte Carlo calculations for photon and electron transport problems is explained. It is applicable to any energy range, especially suitable for a few to 100 MeV, and the shape of incident radiation spectrum can be arbitrary. Complex problems in treatment of bremsstrahlung X-ray are largely removed and photon and electron transport problems are treated symmetrically. Accordingly, the ratio of the total energy of backscattered photons to the total incident electron energy can be easily obtained. Author (NSA)

N71-34768# Michigan State Univ., East Lansing. Dept. of Physics.
THE ORIGIN OF THE SPIN-ORBIT INTERACTION
Peter Signell 31 Aug. 1970 17 p refs Presented at the 3rd Intern. Symp. on Polarization Phenomena in Nucl. Reactions, Madison, Wis., 31 Aug. 1970 Submitted for publication Sponsored by AEC
(COO-2081-10; Conf-700811-14) Avail: NTIS

The origin of the nuclear shell model, spin-orbiting splitting was the object of a number of investigations. These are reviewed both as to origin in two-body nuclear force and ultimately in terms of elementary particle processes. Author (NSA)

N71-34769# Los Alamos Scientific Lab., N. Mex. Nuclear Cross Sections Advisory Committee.
COMPILATION OF REQUESTS FOR NUCLEAR CROSS SECTION MEASUREMENTS
Mar. 1971 222 p Sponsored by AEC
(LA-4652; NCSAC-35) Avail: NTIS

The status of cross-section measurements of importance to the U.S. nuclear energy program is summarized and areas where additional experimental work is needed are indicated. NSA

N71-34770# Gulf Radiation Technology, San Diego, Calif.
INTEGRAL NEUTRON THERMALIZATION Final Report
J. M. Neill, G. M. Borgonovi, D. H. Houston, and E. L. Slaggie 30 Dec. 1970 54 p refs
(Contract AT(04-3)-167)
(GULF-RT-10469) Avail: NTIS

The development of scattering kernels to describe the thermalization of neutrons in important reactor moderators is reported. Results include thermal scattering kernels for Be, BeO, CH2, C6H6, and ZrH2 obtained from basic physics models. The consistency and accuracy of the thermal data as compiled in the ENDF was checked to insure that the system of data retrieval is convenient and suitably user-oriented. The work done on FLANGE is summarized. Checks made directly on the scattering law data in the ENDF are viewed. Comparisons between measured and calculated neutron spectra that were added to the spectrum book are discussed. The conversion of the McMurry-Russell-H2O data to ENDF/B format is described and some difficulties encountered in the use of this model are related. The work on the series of thermal benchmark problems which have served as a test of the Haywood 2 water scattering kernel and of Version 1 and 2 ENDF cross sections for isotopes of uranium and plutonium is summarized. Documentation for descriptions of the scattering kernels and further references contained in the kernel book are presented. NSA

N71-34771# Chicago Univ., Ill. Enrico Fermi Inst.
HIGH ENERGY FISSION OF Ta 181 AND Bi 209 BY 450 MeV PROTONS
John A. Panontin and Nathan Sugarman [1971] 108 p refs Sponsored by AEC
(COO-1167-16; EFINS-71-21) Avail: NTIS

The thick-target recoil properties of a number of fission products from the 450-MeV proton fission of Ta-181 and Bi-209 were measured. The average kinetic energy, average cascade deposition energy, and average anisotropy of an isolated product are calculated from the recoil results. An evaporation calculation including fission as a competing mode of de-excitation is performed, the results of Monte Carlo cascade calculations being employed as input data. The results are used to describe the variation of the average properties of the fissioning nuclei, Z, A, and E*, with the average cascade deposition energy. The characteristics of the most probable fission products, and of the primary fragments leading to them and to the observed products, are then calculated. The results are essentially the same as those found at lower bombarding energies and for comparable nuclides formed in heavy-ion bombardments. Author (NSA)

N71-34772# Southwestern Radiological Health Lab., Las Vegas, Nev. Environmental Surveillance.
OFF SITE SURVEILLANCE ACTIVITIES OF THE SOUTHWESTERN RADIOLOGICAL HEALTH LABORATORY, JANUARY - JUNE 1969
Feb. 1971 41 p Sponsored by AEC
(SWRHL-97-r) Avail: NTIS

During the period January through June 1969, eleven announced nuclear detonations were conducted at the Atomic Energy Commission's Nevada Test Site. None of these events released radioactive material that was detected off-site. One power run of a nuclear reactor rocket engine at the Nuclear Rocket Development Station on June 11, 1969, released gaseous fission products that were detected on one air sampler at the Diablo Highway Maintenance Station on Highway 25. The concentration of I-131, determined from the combined results of the particulate and charcoal filters from this location, was 0.7 pCi/cu m. Some radioactive material from Project Schooner of December 8, 1968, was resuspended from material deposited on and off-site. This material was occasionally found on air samples through March 1969. The maximum gross beta concentration resulting from this resuspension was 55 pCi/cu m at Clark Station on January 13, 1969. The principal gamma-emitter identified in this material was W-181.
Author (NSA)

N71-34773# Chicago Univ., Ill. Enrico Fermi Inst.
NUCLEAR CHEMISTRY RESEARCH Technical Progress Report, 15 Dec. 1969 -15 Dec. 1970
Nathan Sugarman and Anthony Turkevich 15 Dec. 1970 17 p refs
(Contract AT(11-1)-1167)
(COO-1167-13) Avail: NTIS

Research progress in nuclear chemistry in the period Dec. 15, 1969 to Dec. 19, 1970 is briefly reported. The work includes high energy proton fission and spallation studies,

elemental analysis of meteorites and lunar materials, and development of radiation detection equipment. NSA

N71-34774# Atomic Energy Commission, Washington, D.C.
RESEARCH ON CONTROLLED THERMONUCLEAR REACTIONS IN THE USSR
I. N. Golovin et al [Feb. 1971] 33 p Transl. into ENGLISH from Russian report
(AEC-TR-7185) Avail: NTIS

A general review of the research program on plasma physics and controlled thermonuclear in the Soviet Union from 1950 to the present time is given. NSA

N71-34775# Los Alamos Scientific Lab., N. Mex.
SECOND CONFERENCE ON TRANSPORT THEORY
Apr. 1971 659 p refs Conf. held at Blacksburg, Va., 26-29 Jan. 1971 Sponsored by AEC
(CONF-710107) Avail: NTIS

Theoretical and mathematical papers on neutron transport theory are presented. The topics include the following: dense, many particle systems; inelastic scattering; nondegenerate Boltzmann equations; multigroup transport theory; three-dimensional transport theory; neutron transport and diffusion; boundary value problems; two-dimensional problems; symmetric quarter space Milne's problem; transport theory, slab albedo problem; time-dependent transport theory; polarized light studies; and radiative transfer. N.E.N.

N71-34776# Goodyear Atomic Corp., Piketon, Ohio.
ENVIRONMENTAL RADIATION LEVELS AND CONCENTRATIONS. SECOND HALF AND ANNUAL SUMMARIES
B. Kalmon and S. H. Hulett 20 Apr. 1971 14 p
(Contract AT(33-2)-1)
(GAT-629) Avail: NTIS

The average environmental radiation levels for the gaseous diffusion plant, for the second half of 1970 and for the calendar year 1970, are summarized. For the second half of 1970, the water alpha, water beta-gamma, air alpha, and the penetrating background dose rates increased when compared with the first half values. The air beta-gamma value decreased when compared to the first half value. In comparing values for calendar year 1970 with calendar year 1969, the water alpha and air alpha decreased in 1970 while the water beta-gamma and air beta-gamma increased. The penetrating background dose rates remained essentially unchanged. Author (NSA)

N71-34777# Oak Ridge National Lab., Tenn.
NUCLEAR SAFETY PROGRAM Annual Progress Report, period ending 31 Dec. 1970
May 1971 273 p refs
(Contract W-7405-eng-26)
(ORNL-4647) Avail: NTIS

The research during this period is reported. The areas discussed include: (1) failure modes of zircaloy clad fuel rods, (2) LMFBR safety, (3) safety studies for high temperature gas-cooled reactors, and (4) design criteria for piping, pumps, and values. F.O.S.

N71-34778# Argonne National Lab., Ill. Reactor Analysis and Safety Div.
SIZE DISTRIBUTION OF BUBBLES EMITTED FROM SIMULATED CLADDING BREAKS
R. P. Anderson, L. Bova, and C. J. Roop Mar. 1971 43 p refs
(Contract W-31-109-eng-38)
(ANL-7789) Avail: NTIS

The size of fission product gas bubbles released from a simulated break in fuel-element cladding was studied experimentally and analytically. Experiments were performed with a simple gas-ejection loop with the following parametric variation: five gas plenum pressures from 50 to 500 psig, six liquid velocities from 5 to 32 ft/sec., two simulated break diameters, 0.0005 and 0.0016 in., and two ejected gases, argon and nitrogen. For each combination of experimental parameters, the gas ejection area was photographed. Enlargements of the photographs supplied information on the gas-bubble size and the bubble-generating mechanism. Different bubble-generating mechanisms were reviewed. An equation relating bubble diameters calculated from the equation correlated well with bubble diameters measured from the photographs. Author (NSA)

N71-34779# Scientific Translation Service, Ann Arbor, Mich.
ON THE ASYMMETRIC DEFORMATION OF FISSIONING NUCLEI [OB ASIMMETRICHNOI DEFORMATSII DELYASHCHIKHSYA YADER]
V. V. Pashkevich Mar. 1971 25 p refs Transl. into ENGLISH from Russian report JINR-P4-5581 Sponsored by AEC Prepared in cooperation with Argonne Natl. Lab., Ill.
(ANL-Trans-678; JINR-P4-5581) Avail: NTIS

The potential energy of a nucleus at large (scission) deformation is calculated by the shell-correction method. The shape of the nucleus in the zeroth-order approximation is taken to be the Cassinian ovaloid, the deviation being expanded in a series in Legendre polynomials. Asymmetric shapes of the nucleus are studied. A definition of the Woods-Saxon type nuclear potential is given. The single particle spectrum, shell correction, liquid-drop energy and total potential energy are calculated. It is shown that the transuranium nuclei are symmetric at the first barrier and in the second minimum of the potential energy. The second saddle point is situated at large asymmetric deformation. The nuclear asymmetry near the scission point is in qualitative agreement with the experimental data on the asymmetry in the mass distribution of the fission fragments. The agreement between the theoretical results and the experimental data on the fission barriers is improved when the asymmetry is taken into account. Author (NSA)

N71-34780# Scientific Translation Service, Ann Arbor, Mich.
VELOCITY DISTRIBUTION OF ANISOTROPIC DEUTERIUM PLASMAS FROM TIME-RESOLVED NEUTRON SPECTRA
J. Neuhauser Jul. 1970 47 p refs Transl. into ENGLISH from West German report IPP-1/109 Sponsored by AEC Prepared in cooperation with Oak Ridge Natl. Lab., Tenn.
(ORNL-tr-2429; IPP-1/109) Avail: NTIS

A method allowing time resolved measurement of neutron spectra in pulsed discharges is described. It utilizes the known energy dependence of the total neutron cross section of light to medium nuclei for energy selection of the neutrons. The neutrons are detected with plastic scintillators which afford both a high detection probability and a time resolution in the nanosecond range. The method is applied to a theta pinch for investigating the anisotropy and relaxation of the deuteron velocity distribution. It is shown that the ion energy parallel to the magnetic field can readily be measured even at the low neutron yield available at present. Suitable combination of this procedure with known diagnostic methods allows deviations of the velocity distribution from the isotropic Maxwell distribution to be determined with sufficient accuracy. Comparison of the experimental relaxation rate with the theoretically predicted collision relaxation shows that Coulomb collisions are not a sufficient explanation. The short wave mirror instabilities also observed probably make a major contribution to the relaxation of the anisotropic velocity distribution. NSA

N71-34781# California Univ., Berkeley. Lawrence Radiation Lab.
STUDY OF THE NEGATIVE-MASS EFFECT IN THE ADGEZATOR MODEL
P. I. Ryltsev et al [1971] 33 p refs Transl. into ENGLISH from the Russian report JINR-P9-4620
(UCRL-Trans-1426; JINR-P9-4620) Avail: NTIS

Instability of the negative mass type in dense electron beams in the Adgezator model (adiabatic generator of charged toroids) was investigated. The experimental results agree with

recent theoretical predictions on the screening effect on oscillation increment in the perturbed beam. Author (NSA)

N71-34782# Scientific Translation Service, Ann Arbor, Mich.
ANGULAR AND ENERGY DISTRIBUTION OF PARTICLES PRODUCED IN INELASTIC PION-N AND N-N COLLISIONS AT VERY HIGH ENERGIES
V. S. Barashenkov et al [1971] 10 p refs Transl. into ENGLISH from the Russian report JINR-P2-5331 Prepared for Oak Ridge Natl. Lab.
(ORNL-tr-2433; JINR-P2-5331) Avail: NTIS

For the energies more than several dozens of GeV, an analytical approximation of the experimental angular and energy secondary particle distributions in the center of mass system is obtained. This approximation is conveniently applied for calculation of the intranuclear cascades at superhigh energies according to the Monte Carlo method. Author (NSA)

N71-34783# Los Alamos Scientific Lab., N. Mex.
PLANNING FOR THE NUCLEON-NUCLEON PROBLEM AT LAMPF
James E. Simmons Mar. 1971 25 p refs
(Contract W-7405-eng-36)
(LA-4640) Avail: NTIS

A summary is given of the current status of LAMPF in relation to planning for future N-N work, including a description of the experimental area and special features of the neutron and proton beams. A summary is also given of the present condition of the N-N problem at medium energies, including examples of knowledge of the phase shifts, and recent experimental results of interest. Author (NSA)

N71-34784# Chicago Univ., Ill.
EXPERIMENTAL STUDY OF THE BETA DECAY OF POLARIZED LAMBDA HYPERONS
Jerry Mike Watson [1970] 106 p refs
(Contract AT(11-1)-1701)
(COO-1701-147; EFI-71-22) Avail: NTIS

A study is made of the form of the weak interaction in the beta decay of the Lambda hyperon yields proton + electron (-) + antineutrino. The resulting distributions are shown, including mass, momentum, and lifetime. The spin correlations are given. (NSA)

N71-34785# Southeastern Massachusetts Univ., North Dartmouth.
PHOTOPRODUCTION OF PIONS WITH POLARIZED PHOTONS
Z. Bar-Yam, J. de Pagter, J. Dowd, W. Kern, and J. Russell 22 Feb. 1971 65 p refs
(Contract AT(30-1)-4115)
(NYO-4115-1) Avail: NTIS

Results of an extended study on the photoproduction of pions with polarized photons are presented and discussed. The study includes a series of experiments conducted with an electron accelerator covering a large range of photon energies and momentum transfers and involving all charge states of the pion. Author (NSA)

N71-34786# Syracuse Univ., N.Y. Dept. of Physics.
STRANGE PARTICLE PRODUCTION IN THE MULTIPERIPHERAL MODEL
R. F. Amann Mar. 1971 9 p refs Sponsored by AEC
(SU-1206-247; NYO-3399-247) Avail: NTIS

The production of particles carrying a conserved quantum number is investigated in the multiperipheral model. The Chew-Pignotti bootstrap condition is appropriately modified. The available data for strange particle production at laboratory energies are shown to have a natural explanation, within the model, if the effective kaon* intercept is equal to that of the rho mesons. An unexpected result is that, for precisely this value of the kaon* intercept, the ratio of kaons to pions produced rises with energy, in accordance with experimental indications. Author (NSA)

N71-34787# Pittsburgh Univ., Pa. Dept. of Physics.
AXIAL VECTOR CURRENT AND PCAC IN THE SIGMA MODEL
R. H. Maurer and R. S. Willey Apr. 1971 28 p refs
(Contract AT(30-1)-3829)
(NYO-3829-69) Avail: NTIS

An explicit operator construction of the axial vector current in the boson sigma-model is given in perturbation theory. This current is finite and satisfies the PCAC condition with the renormalized pion field. It also (at least formally) satisfied the SU2 x SU2 equal-time time-component current algebra. Author (NSA)

N71-34788# Syracuse Univ., N.Y. Dept. of Physics.
RESTRICTIONS ON THE ANGULAR MOMENTUM OF t-CHANNEL EXCHANGES FROM s-CHANNEL HELICITY CONSERVATION
Maurice L. Blackmon, Marcia J. King, and Kameshwar C. Wali Mar. 1971 10 p refs Sponsored by AEC
(SU-1206-248; NYO-3399-248) Avail: NTIS

It is shown that there are constraints on the angular momentum of t-channel exchanges due to s-channel helicity conservation in the elastic reactions of 0 + S yields 0 + S. Author (NSA)

N71-34789# Columbia Univ., Irvington, N.Y. Nevis Labs.
OBSERVATIONS OF MUON PAIRS IN HIGH ENERGY HADRON COLLISIONS
Bernard G. Pope (Ph.D. Thesis) 1970 145 p refs
(Contract AT(30-1)-1932)
(NEVIS-185; CU-289; R-742) Avail: NTIS

Muon pairs produced in the collisions of 30-GeV protons with a uranium target were observed. The direction and range of each muon were measured, and the effective mass of the pair calculated. The production cross section was seen to vary smoothly with mass. No evidence of resonant structure was found. Data were taken at incident proton energies of 22, 25, 28.5, and 29.5 GeV. Within the experimental aperture, the total cross section increased with energy by a factor of 5 over this range. The experimental results are compared with the predictions of some theoretical models. Author (NSA)

N71-34790# Chicago Univ., Ill. Enrico Fermi Inst.
TENSOR MESON DOMINANCE AND REGGE COUPLINGS
Peter G. O. Freund Feb. 1971 22 p refs
(Contract AT(11-1)-264)
(COO-264-572; EFI-71-8) Avail: NTIS

The helicity structure of mesonic Regge couplings is discussed in the context of meson pole dominance for the matrix elements of vector currents and of the energy momentum tensor. Experimental tests of this helicity structure are proposed. The obtained couplings are incompatible with the symmetric quark model, and they therefore provide a guide toward symmetry breaking. Universal couplings for higher spin (J greater than 2) mesons are considered. Author (NSA)

N71-34791# California Univ., Berkeley. Lawrence Radiation Lab.
A2 DUPLICITY: A COMPILATION OF THE AMOUNT OF DIPOLE STRUCTURE OBSERVED IN A2 MESON EXPERIMENTS
Gerald R. Lynch 10 Mar. 1971 3 p refs
(Contract W-7405-eng-48)
(UCRL-20622) Avail: NTIS

In order to compare experiments for splitting in the A2 meson, these experiments are fit to a distribution containing a parameter, called duplicity, which measures the amount of dipole

structure observed in an experiment. The experiments are listed showing the resolution, duplicity, and S values. Author (NSA)

N71-34792# Purdue Univ., Lafayette, Ind.
EVIDENCE FOR SPLITTING IN THE Q REGION OF KAON(PLUS) PION(PLUS) PION(MINUS) MASS
A. F. Garfinkel, R. F. Holland, D. D. Carmony, H. W Clopp, D. Cords et al [1970] 10 p refs Prepared in cooperation with Calif. Univ., Davis Sponsored by AEC
(COO-1428-270) Avail: NTIS

A splitting in the kaon(+) pion(+) pion(-) mass spectrum in kaon(+) deuteron interactions at 9 GeV/c is observed. A mass of 1243 + or -8 MeV/sq c and a width of 70 + 26 or -18 for the lower mass state, and mass of 1344 + or -4 and a width of less than 40 MeV/sq c for the higher mass state are found. The isospin of both states is determined to be 1/2. The results can be interpreted as evidence for the mixing of two J sup P = 1(+) K^* states. Author (NSA)

N71-34793# California Univ., San Diego. Dept of Chemistry.
DIFFRACTIVE POMERON BOOTSTRAP AND MULTI-PERIPHERAL FRAGMENTATION
Dennis Silverman, Peter D. Ting, and Harry J. Yesian [1970] 13 p refs Sponsored in part by AEC
(UCSD-10-P-10-77) Avail: NTIS

The diffractive Pomeron pole given by T(s,t) = is beta(t) is derived from a multiperipheral bootstrap where the Pomeron is required to be exchanged only once. This model corresponds to a fragmentation picture and its predictions for inclusive experiments are presented. These predictions are contrasted with those of multi-Pomeron exchange models and shown to provide tests for the nature of the Pomeranchuk singularity. Author (NSA)

N71-34794# California Univ., Berkeley. Lawrence Radiation Lab.
BEAM-SURROUNDING INTERACTIONS AND THE STABILITY OF RELATIVISTIC PARTICLE BEAMS
Andrew M. Sessler Feb. 1971 6 p refs Presented at Natl. Accelerator Conf., Chicago, 1-3 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20607; Conf-710308-11) Avail: NTIS

A review on the interaction of a relativistic particle beam with itself which is a result of the coupling of the beam with its surroundings is presented. The static self-field phenomena including transverse oscillations, longitudinal oscillations, and the bunch length in electron storage rings are discussed. Also, the dynamic self-field phenomena, particularly the coherent longitudinal instability of a uniform beam, are reviewed. NSA

N71-34795# Princeton Univ., N.J. Elementary Particles Lab.
SEARCH FOR VIOLATION OF CP INVARIANCE IN THE DECAY OF KAONS(PLUS OR MINUS) INTO THE TAU MODE
Paul Allen Souder Feb. 1971 177 p refs
(Contract AT(30-1)-4159)
(PURC-4159-24; TR-7) Avail: NTIS

The Dalitz plot distributions of 1.6 million tau(+) decays, Kaon(+) yields pion(+) pion(-), and an equal number of tau(-) decays, kaon(-) yields pion(-) pion(-) pion(+), were compared. This experiment was performed in a 3 GeV/c partially separated beam. Kaons decaying into three pions were detected by a threefold coincidence in an eight-counter hodoscope. The directions of all three pions were measured in a set of five wire spark chambers, and a wide aperture spectrometer magnet and six more wire spark chambers served to determine the momentum of the odd pion. The data were taken and analyzed in exactly the same way for both positive and negative beams. Numerous checks were made to ensure that the apparatus treated both decays identically. No statistically significant difference between tau(+) and tau(-) decay was found in any region of the Dalitz plot. In terms of the slope parameters A(+) and A(-) for the odd pion energy spectra in the rest frame of the kaon, the asymmetry is (A(+)-A(-)/A(+)+A(-) = -0.0070 + or - 0.0053. These results are consistent with no CP violation in tau decay. Author (NSA)

N71-34796# Syracuse Univ., N.Y. Dept. of Physics.
SOME QUARK-PARTON MODEL INEQUALITIES FOR THE NEUTRON AND PROTON INELASTIC STRUCTURE FUNCTIONS
D. P. Majumdar Feb. 1971 14 p refs Sponsored by AEC
(SU-1206-244; NYO-3398-244) Avail: NTIS

Several inequalities are summarized for a neutron and proton inelastic structure function that must be satisfied if the protons are identified with quarks. Some of these inequalities provide very useful constraint equations for the F(N) function of the parton model. Due to lack of sufficient data it is not certain at present if all the inequalities are satisfied. The importance of these inequalities lies in the fact that if any of these are confirmed as not satisfying the experimental data, the concept of individual quark-parton association has to be abandoned. Author(NSA)

N71-34797# Rochester Univ., N.Y., Dept. of Physics and Astronomy.
DIFFRACTION PRODUCTION OF BOSONS
T. Ferbel 29 Mar. 1971 45 p refs
(Contract AT(30-1)-875)
(UR-875-337) Avail: NTIS

Recent results obtained in the analysis of diffractively produced multimeson systems are summarized, and speculation is made on the mechanism responsible for these production processes. Author (NSA)

N71-34798# California Univ., Berkeley. Lawrence Radiation Lab.
SESSION 1: CRYOGENIC MAGNETS AND SYNCHROTRONS. CRYOGENIC AND VACUUM TECHNOLOGIES. PANEL DISCUSSION ON SUPERCONDUCTING SYNCHROTRONS
William S. Gilbert Feb. 1971 7 p refs Presented at the Natl. Particle Accelerator Conf., Chicago, 1-3 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20605; Conf-710308-23) Avail: NTIS

Some recent developments in pulse dipole magnets for superconducting proton synchrotrons are outlined. Fine wire developments, model pulse dipole results, and cost estimates are discussed. NSA

N71-34799# California Univ., Berkeley. Lawrence Radiation Lab.
RECENT EXPERIMENTS ON FORMING ELECTRON RINGS AT BERKELEY
G. R. Lambertson, D. Keefe, L. J. Laslett, W. A. Perkins, J. M. Peterson et al Feb. 1971 4 p refs Presented at the Natl. Particle Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20183; Conf-710308-27) Avail: NTIS

In the initial electron-ring experiments with a new high-current, 2 MeV electron injector, an efficient method of trapping of the injected beam was developed and a suitable compression cycle was found in which betatron amplitude growth on single-particle resonances is negligible. The ring behavior is satisfactory during the compression cycle at low intensity. At higher intensities the lowest mode of the coherent radial instability appeared, but the threshold for its onset was raised considerably by increasing the Landau damping coefficient, so that it is no longer the limiting instability. Increasing the energy spread in the beam has raised the threshold for several phenomena observed in connection with this instability. Changing the electromagnetic environment of the electron rings to suppress this instability is considered. Author (NSA)

N71-34800# Oak Ridge National Lab., Tenn.
HIGH PERFORMANCE HEAVY-ION SOURCE FOR CYCLOTRONS
E. D. Hudson, M. L. Mallory, and S. W. Mosko May 1971 9 p refs Presented at the Natl. Part. Accelerator Conf., Chicago, 1 Mar. 1971
(Contract W-7405-eng-26)
(ORNL-TM-3391; Conf-710308-22) Avail: NTIS

A cold cathode Penning discharge ion source, power supply, and its performance in the isochronous cyclotron are described. The ion source has operated at power levels as high as 8 kW and has produced a variety of particle beams, ranging from deuterium to xenon and with charge states up to +12. In particular, 20 electrical microamperes of O-16,18(+5), 5 x 10 to the 4th power p/sec (particle per second) of Ar-40(+10), and 10 to the 7th power p/sec of Xe-132(+12) were extracted. From the known intensities of accelerated ions and the calculated total ionization potential, a means of predicting particle intensity for a given charge state was developed.
Author (NSA)

N71-34801# Argonne National Lab., Ill.
DBLSCAT: A COMPUTER CODE FOR DOUBLE-SCATTERING CORRECTIONS
A. K. Agrawal, S. G. Das, and F. M. Mueller Feb. 1971 30 p refs
(Contract W-31-109-eng-38)
(ANL-7780) Avail: NTIS

The DBLSCAT, a FORTRAN 4 computer program, for calculating the second-order scattering correction for double-differential slow-neutron scattering experiments in an infinite, plane-slab geometry is described. A brief description of the theory (with special cases), a discussion of numerical techniques used, input and output descriptions, sample problems, and the FORTRAN 4 listing of the computer code are included. The program allows for both transmission- and reflection-type experiment geometries. The method used to calculate double-scattering correction is based on Vineyard's approach, except that there are no assumptions regarding the nature of the scattering cross section. Triple integrations appearing in the expression for second-order scattered-neutron current are carried out using a specified number of mesh points. The code was written with particular emphasis on efficiency and compactness.
Author (NSA)

N71-34802# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
USE OF CF-252 AS A RANDOMLY PULSED NEUTRON SOURCE FOR PROMPT NEUTRON DECAY MEASUREMENTS
J. T. Mihalczo (Ph.D. Thesis - Tenn. Univ.) 6 Jan. 1971 104 p refs
(Contract W-7405-eng-26)
(Y-DR-41) Avail: NTIS

Cross correlation measurements were performed for unmoderated and polyethylene-moderated uranium assemblies with prompt neutron decay constants. One of the detectors was an ionization chamber containing Cf-252 which triggered the time analysis equipment every time a spontaneous fission of Cf occurred. The other was a proton recoil scintillator which measured the response of the multiplying assembly to the neutrons emitted in the Cf fission. These measurements used Cf as a randomly pulsed neutron source but had the simplicity of the Rossi-alpha technique. The randomly pulsed neutron method allowed the measurement of the prompt neutron decay without the use of a complicated pulsed neutron source where Rossi-alpha measurements were not practical. In assemblies for which Rossi-alpha measurements were also made, the prompt neutron decay constant agreed within the precision of the measurements with those obtained by this technique.
Author (NSA)

N71-34803# Syracuse Univ., N.Y. Dept. of Physics.
DELTA I EQUALS MASS DIFFERENCES AND ETA MESON YIELDS 3 PION DECAY
J. Schechter and Y. Ueda 1970 32 p refs Sponsored by AEC
(SU-1206-245; NYO-3399-245) Avail: NTIS

The octet baryon Delta I equals 1 mass shifts, kaon electromagnetic mass shift, and eta meson yields 3 pion decay amplitude are all correlated in the framework of the linear SU(3) sigma model. It is shown how this model provides a natural realization of the tadpole idea of Coleman and Glashow. An attempt is made to resolve the long standing mystery associated with the eta meson yields 3 pion process, and the rare mode eta' meson yields 3 pion is also calculated. It is also shown that the chiral breaking and isospin breaking coefficients in the Lagrangian have the same order of magnitude.
Author (NSA)

N71-34804# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
CALCULATIONS OF PROPERTIES OF THE THREE-NUCLEON SYSTEMS WITH LOCAL POTENTIALS
B. Akhmadkhodzaev (Inst. of Nucl. Phys., Tashkent, USSR), V. B. Belyaev, J. Wrzecionko (Inst. for Nucl. Res., Warsaw, Poland), and A. L. Zubarev (Tashkent Univ., USSR) 21 Apr. 1971 16 p refs
(JINR-E4-5763) Avail: AEC Depository Libraries

The Faddeev equations for three-nucleon systems are solved for a number of local (including realistic) potentials with a soft or hard core. The energy and wave functions of the bound states of H-3 and hypertriton nuclei as well as the doublet and quartet nd-scattering length are calculated. Dependence of the above quantities on the functional shape of potential and the magnitude of singlet effective range is determined. The value of the axial matrix element in beta decay of H-3 and the probability of mu capture on He-3 nucleus is also computed. The latter calculations make it possible to find the value of weak pseudoscalar coupling constant gp = 5.3gA.
Author (NSA)

N71-34805# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
MULTIPLEX TARGET
L. M. Soroko 1971 7 p ref In RUSSIAN; ENGLISH summary
(JINR-P13-5699) Avail: NTIS

The multiplex Hadamard-transform target designed to measure the angular distribution of particles in the presence of large back-ground in the experimental hall is described. The gain in the effective signal-to-background ratio achieved by this multiplex target is the result of spatial multiplexing, that is, of coding the angular distribution to be measured before counting it. The multiplex target has a multi-element heterogene structure, which permits the measurement of particles at several angles simultaneously by the integral coding algorithm. The transform code is the cyclic trans-orthogonal Hadamard code. The angular distribution of particles to be measured can be found at the second stage by decoding transformation with the same code, as was used on the stage of primary coding.
Author (NSA)

N71-34806# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
HIGH ENERGY SCATTERING IN phi-3 THEORY AND THE BREAKDOWN OF EIKONAL APPROXIMATION, PART 1
Hung Cheng (MIT, Cambridge, Mass.) and Tai Tsun Wu (Harvard Univ., Cambridge Mass.) Mar. 1971 55 p refs
(Contract AT(30-1)-4101; Grant NSF GP-13775)
(DESY-71/13-Pt-1) Avail: NTIS

In order to test the general validity of the impact picture which was extracted from quantum electrodynamics at high energies, a systematic study of high energy scattering amplitudes in phi sup 3 theory is made. The method used is the one developed in the treatment of quantum electrodynamics, and it enables one to obtain in closed forms the asymptotic amplitudes for multiple exchanges of Regge poles and scalar particles. The result is nonperturbative and is valid to all orders of the coupling constant. It is shown in various examples that: the longitudinal

momentum of the incident particle is always distributed in positive fractions by the particles created; an exchange particle, either composite (Regge pole) or elementary, can carry only transverse momentum; the scattering amplitude satisfies the impact factor representation; and except in the leading order of the coupling constant, the simple exponentation form of the eikonal approximation does not appear. Author (NSA)

N71-34807# Tokyo Univ. (Japan). Inst. for Nuclear Study.
PDP-9 PROGRAMS FOR INS FM ANALYZER. 3: CKSPAO
Jun Kokame 1 Dec. 1970 22 p In JAPANESE
(INS-TL-109) Avail: AEC Depository Libraries

The program CKSPAO is one of the programs which for a PDP-9 computer to perform various experiments with a FM cyclotron analyzer is described. It was developed to easily detect the direction of the incident beam which travels through the center of a target or the center axis of a scattering tank. The program utilizes the fact that the energy level of particles scattered elastically varies with the angle of the laboratory system, so that the measurement may be performed in one direction either on the plus or minus side of the beam. The usage, contents, constitution, and measurement errors of the program are described. Typical flow charts and the FORTRAN program are shown. Author (NSA)

N71-34808# United Kingdom Atomic Energy Authority, Harwell (England).
EMISSION OF DELAYED NEUTRONS: CALCULATION OF ENERGY SPECTRA AND OF PRECURSOR EMISSION PROBABILITIES [EMMISSION DE NEUTRONS RETARDES: CALCUL DES SPECTRES D-ENERGIE ET DES PROBABILITIES D'EMISSION DES PRECURSEURS]
H. Gauvin et al Feb. 1970 28 p refs Transl. into ENGLISH from Proc. of Phys. and Chem. of Fission Conf. (Vienna), 1969 621-636
(LB/G-2943; Conf-690708-8; SM-122/85) Avail: AEC Depository Libraries

The calculations are intended to explain the delayed neutron emission (energy spectra and emission probabilities P sub n) that follows the beta(-) disintegration of the precursors produced by fission. The probability of beta (-) transition, the level density omega (E,J) of the emitter, and the competition of (beta(-), gamma) and (beta(-),neutron) de-excitations are analyzed for each precursor studied. All the possible channels open to the process of neutron emission on grounds of energy considerations are taken into account through the introduction of the spin and parity selection rules at each stage of the sequence: precursor, emitter, final nucleus. The results are compared with the known experimental measurements of the neutron energy spectra and probabilities P sub n. The precursors Br-87, Br-88, I-137, and Rb-93, 97 were selected for this examination. Author (NSA)

N71-34809# United Kingdom Atomic Energy Authority, Harwell (England).
THERMAL NEUTRON CAPTURE CROSS SECTIONS OF U-234 AND U-236
M. J. Cabell and M. Wilkins Mar. 1971 6 p refs
(AERE-R-6761) Avail: AEC Depository Libraries; HMSO 1s 10d; SIS 80.40

Aliquots of mixtures prepared from isotopically pure U-234 (98.84%) and isotopically enriched U-236 (99.76%) and U-238 (99.996%) were irradiated, with cobalt monitors, in a reactor for approximately two years. The irradiation positions chosen provided essentially thermal neutrons of known temperature (116 + or - 9 C). After irradiation the uranium was purified by reverse-phase partition chromatography, then mass analyzed. Un-irradiated samples of the mixtures were mass analyzed in a similar way. The activities of the cobalt monitors were determined absolutely, and the neutron doses they received were then calculated. The neutron capture cross sections of U-234 and U-236 for the reactor neutrons were found to be 101.1 + or - 1.3b and 8.88 + or - 4.00b, respectively, and from these figures the capture cross sections for Maxwellian neutrons were deduced as 100.5 + or - 1.3b and 8.47 + or - 4.00b. Author (NSA)

N71-34810# Reactor Centrum Nederland, Petten.
TRACE DETERMINATION OF CADMIUM BY NEUTRON ACTIVATION. APPLICATION TO AIR-BORNE PARTICULATES, HAIR AND FOODSTUFFS
H. A. Das and H. H. De Vries Feb. 1971 10 p refs
(RCN-136) Avail: AEC Depository Libraries

A routine procedure by neutron activation for determination of cadmium in industrial air-borne particulate samples, collected on filter paper, hair, and foodstuffs described. Cadmium is isolated by liquid-liquid extraction with a chloroform solution of dithizone. The activity of the In-115 daughter is counted. The method was tested by analysis of standard kale powder. Author (NSA)

N71-34811# Pittsburgh Univ., Pa. Dept. of Physics.
PHENOMENOLOGICAL EFFECTIVE LAGRANGIAN AND THE REACTIONS GAMMA PLUS GAMMA YIELDS PIONS
Tau Yao Mar. 1971 7 p refs
(Contract AT(30-1)-3829)
(NYO-3829-68) Avail: NTIS

A phenomenological effective Lagrangian for the annihilation of two photons into pions is generalized. The Lagrangian gives photon annihilation into both even and odd number of pions, and is free from any arbitrary parameter. All production cross sections are found to increase with increasing energies, a feature common to many effective Lagrangian models. Near threshold pion(+) pion(-) pion(0) production is found to be comparable to that of 3 pions(0) production, while at higher energies the charged mode dominates over the neutral mode. Author (NSA)

N71-34812# American Micromation Industries, Inc., Philadelphia, Pa.
MULTICHARGED ION SOURCES [ISTOCHNIKI MNOGOZARYADNYKH IONOV]
E. D. Vorob'ev et al Mar. 1971 28 p refs Transl. into ENGLISH from Russian report JINR-P7-5177 Presented at 14th All Union Conf. on Emission Electron., Tashkent, USSR, May 1970 Sponsored by AEC Prepared for ANL
(ANL-Trans-876; CONF-700565-1) Avail: NTIS

Heavy ions may be produced by an arc discharge, electron bombardment under an ultrahigh vacuum, the interaction of a laser beam with the surface of a solid or with a gas, or by a high-power spark discharge. The design and operation of various sources are described, and performance data are presented. NSA

N71-34813# Los Alamos Scientific Lab., N. Mex.
TOTAL ABSORPTION IONIZATION CHAMBER FOR 1.8-10keV X-RAYS
F. B. Lyons, J. A. Baran, and J. H. McCrary Dec. 1970 14 p refs
(Contract W-7405-eng-36)
(LA-4588) Avail: NTIS

The design of a xenon gas ionization chamber is presented. Corrections to energy fluence measurements are considered. The correction for escape of xenon fluorescent L X-rays was measured with a xenon-methane proportional counter. The chamber was compared to a Si(Li) detector and an argon-methane proportional counter over the energy range from 1.7 to 10.5 keV. The chamber was shown to be accurate to 2% independent of uncertainties in entrance window transmission. Overall chamber accuracy was 3%. The useful energy fluence rate range for the chamber was shown to be from below 10 to the minus 11th power to 6x10 to the minus 5th W/sq cm. A value of 21.5 0.4 eV for the mean energy per ion pair in xenon was obtained from the measurements. It was concluded that a chamber useful up to 35 keV could be constructed without

accuracy degradation by an increase in chamber size.
Author (NSA)

N71-34814# California Univ., Berkeley. Lawrence Radiation Lab.
PARTICLE DETECTORS BASED ON NOBLE LIQUIDS
Richard A. Muller, Stephen E. Derenzo, Robert G. Smits, Haim Zaklad, and Luis W. Alvarez Sep. 1970 8 p refs Presented at the Intern. Conf. on Instrumentation for High Energy Phys., Dubna, USSR, 8-12 Sep. 1970
(Contract W-7405-eng-48)
(UCRL-20135; CONF-700902-7) Avail: NTIS

In order to build a thin particle detector with 10 micron spatial resolution and automatic readout, the avalanche of ionization electrons in high electric fields in liquid argon and liquid xenon was studied. A scheme using an array of points that could be used to make a reliable liquid argon filled detector is presented. The avalanche pulses in liquid xenon have a rise time more than three orders of magnitude faster than that in liquid argon, suggesting that the positive charge carriers are holes, and making possible a detector with a time resolution of better than 100 nanoseconds. A direct observation of hole conduction is described. Author (NSA)

N71-34815# Atomic Energy Commission, New York. Health and Safety Lab.
FALLOUT PROGRAM Quarterly Summary Report, 1 Dec. 1970 - 1 Mar. 1971
Edward P. Hardy, Jr. 1 Apr. 1971 320 p refs
(HASL-242) Avail: NTIS

A compilation of natural radioactivity in man and the environment from secondary sources is presented. The effects of different dietary habits on the uptake of Sr-90 in bone among the white, Bantu, Indian, and colored peoples of South Africa are summarized. An analysis of C-14, from atmospheric nuclear explosions, in sea water collected at various ocean depths is reported as well as a comparison of gamma spectrometric and radiochemical analysis of Zr-95, Cs-137, and Ce-144 in surface air samples. Calculations of the Sr-90 yield of the tenth Chinese nuclear explosion are given along with fallout monitoring data from French nuclear tests. Estimates of Sr-90 intake via the total diet in New York City and San Francisco are summarized from quarterly food samplings and average consumption statistics from 1960 through 1970. J.M.

N71-34816# Brookhaven National Lab., Upton, N.Y.
GeV STORAGE RINGS, 2
John P. Blewett 7 Apr. 1971 11 p ref
(BNL-15792) Avail: NTIS

A lattice is proposed for storage rings of very high energy using superconducting magnets. Two intersecting rings run adjacent to each other and can be contained in a single dewar system. Solutions to the problem of operation of adjacent sircore dipoles are presented. Author (NSA)

N71-34817# Los Alamos Scientific Lab., N. Mex.
DISCRETE ORDINATES TREATMENT OF INDUCED SCATTERING
K. D. Lathrop Feb. 1971 5 p refs
(Contract W-7405-eng-36)
(LA-4646) Avail: NTIS

A transport equation including nonlinear induced scattering effects is written for the photon flux (speed of light times the density). A finite Legendre polynomial expansion is used to represent the scattering transfer probability (differential cross section). A multigroup formulation is derived with appropriate definitions of multigroup coefficients. Treatment of the induced scattering terms (including iterative strategy) in standard discrete ordinates programs is outlined. Author (NSA)

N71-34818# Pennsylvania State Univ., University Park.
THE EXPERIMENTAL AND THEORETICAL INVESTIGATION OF AN INTERNAL ELECTROSTATIC CONFINEMENT DEVICE Progress Report, 15 Jun. 1969 - 15 Mar. 1971
1969 19 p refs
(Contract AT(30-1)-4109)
(NYO-4109-2) Avail: NTIS

The development and use of the following two diagnostic techniques are described: (1) an electron beam probe to measure potential, and (2) analysis of Doppler-shifted spectral lines to study the presence of fast particles in the system. A general steady-state theory, based on the solution of the Vlasov equation, was used to obtain potential profiles with varying amounts of trapped particles. NSA

N71-34819# Oak Ridge National Lab., Tenn.
ALKALI CHLORIDE ELECTROLYSIS STUDIES BY TRACER TECHNIQUES
Bela Balla et al [1971] 7 p refs Transl. into ENGLISH from Kem. Kozlem. (Hungary), v. 37, 1969 p 173-178 Sponsored by AEC
(ORNL-TR-2487) Avail: NTIS

A radioisotopic method for determination of mercury in electrolytic cells is described. Uses of Au-198 and Hg-203 were evaluated for determining the amount of mercury and Hg-203 chosen. NSA

N71-34820# Texas Univ., Austin. Center for Nuclear Studies.
RESEARCH IN NUCLEAR PHYSICS Progress Report
Dec. 1970 159 p refs
(Contract AT(40-1)-2972)
(ORO-2972-10; PR-9) Avail: NTIS

Experimental and theoretical research at the Center for Nuclear Studies of the University of Texas in 1970 is reported. Improvements in the experimental facilities are also briefly described. NSA

N71-34821# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
NUCLEAR REACTIONS IN LIGHT NUCLEI AND MOESSBAUER STUDIES
Oct. 1970 200 p refs
(Contract AT(30-1)-2028)
(NYO-2028-5) Avail: NTIS

Multipole mixing ratios for aluminum-27 energy level transitions from proton inelastic scattering; nuclear electric and magnetic moments for boron-12 and samarium-147; and a NMR analysis of the iron-57 energy level at 14.4 keV are reported. Moessbauer studies of hyperfine field temperature dependences in dysprosium alloys and systems; paramagnetic relaxation in hexahydrated dysprosium chlorides; lutetium-175 energy level lifetimes at 113.8 keV, hyperfine interactions in neodymium alloys and systems; magnetic moments of the promethium-147 energy level at 91.06 keV magnetic anisotropy of iron-rare earth alloys and systems; and isomer shifts and lifetimes of the tungsten-183 energy level at 99 keV are summarized. The Debye-Waller factor is discussed for improved approximation to the Moessbauer effect. The development of Compton polarimeters with lithium-drifted germanium detectors is also cited. J.M.

N71-34822# Clark Univ., Worcester, Mass. Dept. of Chemistry.
NUCLEAR CHEMISTRY Progress Report, 1 Jan. - 31 Dec. 1970
Daag S. Brenner 31 Dec. 1970 32 p refs
(Contract AT(30-1)-3950)
(NYO-3950-3) Avail: NTIS

Progress in nuclear chemistry research during 1970 is reported. The research was principally on nuclear decay schemes. Some previously unreported data on Er-161 decay is given. NSA

N71-34823# California Univ., Berkeley. Lawrence Radiation Lab.
RADIATION EFFECTS IN THE DYNAMICS OF RELATIVISTIC ELECTRON RINGS
A. A. Kolomenskii Jan. 1971 28 p refs Transl. into ENGLISH from Russian report LEBEDEN-70-155 Sponsored by AEC
(UCRL-Trans-1435) Avail: NTIS

The effects of synchrotron radiation from electrons in compressors for electron-ring accelerators are evaluated. The equations of motion with relativistic radiation of electrons in a magnetic system, the equilibrium motion of the radiating electron in the induction condition, the nonequilibrium motion of the radiating electron, and the application of the results obtained to the dynamics of the electron ring are studied. NSA

N71-34824# Addis Translations International, Woodside, Calif.
COUPLING AND DECOUPLING OF BETATRON OSCILLATIONS BY LONGITUDINAL MAGNETIC FIELDS, WITH APPLICATIONS TO THE LONGITUDINAL DETECTOR FIELD IN A STORAGE RING [UEBER DIE KOPPLUNG UND ENTKOPPLUNG DER BETATRONSCHWINGUNGEN DURCH LONGITUDINALE MAGNETFELDER MIT ANWENDUNGEN AUF DAS LONGITUDINALE DETEKTORFELD IM STORAGE-RING]
Gerhard Ripken Jan. 1971 11 p refs Transl. into ENGLISH from the German report Sponsored by AEC
(SLAC-Trans-131) Avail: NTIS

It is shown that with any field shape the betatron oscillation coupling caused by the longitudinal detector field can be exactly reversed by longitudinal compensating fields if the path integral over the longitudinal component of the total field vanishes. This is proved by switching to an appropriate coordinate system rotated about the S-axis, in which the betatron oscillations are decoupled. Condition equations for the Q shift and for the closed-orbit shift that occurs with a finite angle of intersection are given within the framework of the linear machine theory.
Author (NSA)

N71-34825# Technische Hochschule Munchen (West Germany).
ENERGY TRANSPORT IN ELECTROMAGNETIC WAVE FIELDS [ENERGIETRANSPORT IN ELEKTROMAGNETISCHEN WELLENFELDERN]
Horst Liska (Ph.D. Thesis) 16 Dec. 1970 19 p refs In GERMAN
Avail: NTIS

The energy transport in electromagnetic wave fields with conductivities and wavelengths of similar order of magnitudes is reported. It is shown that the energy wave has a tendency to propagate linearly and that the field is limited through its boundary conditions within the waveguide. Each inhomogeneity in the transmission flow triggers additional wave forms that affect energy transport and energy distribution by eddy formations. Transl. by G.G.

N71-34826# California Univ., Berkeley. Lawrence Radiation Lab.
THE BRANCHING RATIO KAON YIELDS MUON NEUTRINO: A TEST OF V-A THEORY OF WEAK INTERACTIONS
John Frederick McReynolds (Ph.D. Thesis) 16 Sep. 1970 66 p refs
(Contract W-7405-eng-48)
(UCRL-20031) Avail: NTIS

An optical spark chamber experiment utilizing an axially focusing cylindrically symmetric spectrometer has gathered 62.6 + or - 11 K yields electron neutrino events, giving a branching ratio of (K sub 2e)/(K sub 2 muons) = 2.32 + or - 0.39 x 10 to the minus 5th power. A beam of 500 K(+) pulse with K(+)/pion(+) = 0.002 from the Bevatron external proton beam was stopped on the spectrometer axis. Charged particles over 0.4 of 4 pions were allowed a single orbit in the spectrometer. Such particles in a 12% momentum bite passed through a 300 psi ethane Cherenkov counter, a scintillator and spark chamber array designed for + or - 1% momentum analysis, and into a lead cylinder, spark chamber, and scintillator array designed for muon rejection. Events were scanned and measured on SASS, an automatic scanning system. A total of 150,000 events were measured, analyzed, and kinematically reconstructed. These events satisfied trigger requirements for K sub 2e for K yields charged particle + gamma, and for normalization to K sub 2 muon, K sub 2 pion, and K sub 3e. Author (NSA)

N71-34827# Atomic Energy Commission Research Establishment, Riso (Denmark). Chemistry Dept.
MOSSPEC: A PROGRAMME FOR RESOLVING MOESSBAUER SPECTRA
A. J. Stone, H. J. Aagaard, and J. Fenger Feb. 1971 42 p
(RISO-M-1348) Avail: AEC Depository Libraries

The program fits a sum of Lorentzian lines to a given Moessbauer spectrum by means of the Gauss nonlinear regression procedure with a facility for constraining any set of parameters or linear combinations of parameters. The results are presented as a table of the fitted parameters, a typewriter plot of the residual deviations with an indication of the fit, and a plot of the measured points and the fitted lines; if desired the results of each iteration can also be printed out. Author (NSA)

N71-34828# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fizik.
METHODS FOR MONITORING PROTON INCIDENCE ON THE INTERNAL TARGETS OF HIGH ENERGY ACCELERATORS
Yu. M. Goryachev, V. P. Kantsvets, B. V. Morozov, N. A. Nikiforov, and A. S. Starostin 1970 8 p refs in RUSSIAN; ENGLISH summary
(NP-18776) Avail: AEC Depository Libraries

Methods of absolute and relative monitoring of protons incident on an internal target of high-energy accelerators are described. The techniques have been developed to investigate absolute and relative production cross-sections for deuterons, protons and pions as functions of the target's mass number, but such techniques can be used to measure the cross-section of any other reaction. Author (NSA)

N71-34829# Scientific Translation Service, Ann Arbor, Mich.
SEXTUPOLE LENSES WITH IMPROVED NONLINEARITY IN SLOW EJECTION SYSTEMS
A. V. Galchun and Yu. P. Sivkov 1970 10 p refs in RUSSIAN; ENGLISH summary
(NP-18799) Avail: AEC Depository Libraries

Application of sextupole lenses with considerable drop-off of a field on the aperture edge in the slow ejection system was considered. Calculations have shown, that application of these lenses allows one to decrease the swing amplitude and to improve slightly the emittance of the external beam as well as to reduce the total length of lenses on the ring. Author (NSA)

N71-34830# Pittsburgh Univ., Pa. Dept. of Physics.
REMARKS ON THE THEORY OF PARTICLES WITH SPIN UP TO ONE IN EXTERNAL FIELDS
R. Seiler 1971 21 p refs Presented at Conf. on Fundamental Interactions at High Energy, Coral Gables, Fla., 20 Jan. 1971
(Contract AT(30-1)-3829)
(NYO-3829-66; Conf-710106-7) Avail: NTIS

The quantum theory of particles with spin zero and one half coupled to external fields is treated. The existence and uniqueness of the time evolution operator and S-matrix is shown for certain couplings and locality of the field. Also considered are explicitly solvable models and the breakdown of perturbation theory. NSA

N71-34831# Massachusetts Inst. of Tech., Cambridge.
DUALITY AND DUAL MODELS
G. Veneziano 1970 28 p refs Presented at 15th Intern. Conf. on High Energy Phys., Kiev, 26 Aug. 1970
(Contract AT(30-1)-2098)
(MIT-2098-726; Conf-700806-58) Avail: NTIS

The general aspects of duality, dual models in the tree approximation, and beyond the tree approximation are discussed. NSA

N71-34832# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Neutronenphysik und Reaktortechnik.
STRATEGY FOR SPEEDING UP TWO-DIMENSIONAL SN-METHODS WITH THE HELP OF THE COARSE LATTICE TECHNIQUE [STRATEGIEN ZUR BESCHLEUNIGUNG ZWEIDIMENSIONALER SN-VERFAHREN MIT HILFE DER GROBGITTERTECHNIK]
W. Kinnebrock Jan. 1971 14 p refs in GERMAN; ENGLISH summary
(KFK-1361) Avail: AEC Depository Libraries

The time of two dimensional SN-calculations can be shortened if the initial flux is prepared by a SN-calculation with less spatial points. Also this initial calculation can be shortened in time in the same way. In this connection there arises the question for a strategy, which influences the global calculation-time in an optimal way. Presented is a statistical interpretation of 120 transport-problems, calculated by the two dimensional SN-code SNOW with different strategies. Simultaneously there is developed a theory, describing the calculation-time in dependence of the applied strategy. This theory made it possible to find strategies which save about 60% calculation-time in the mean. Author (NSA)

N71-34833# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
ON THE ACCURACY OF THE PHOTON-DIFFERENCE METHOD USED IN HIGH ENERGY PHOTONUCLEAR EXPERIMENTS
K. Tesch Jan. 1971 18 p refs
(DESY-71/3) Avail: AEC Depository Libraries

The accuracy in calculating the cross sections per photon, sigma sub k, from a set of measured cross sections per equivalent gamma quantum, sigma sub q, is discussed. Four commonly used approximations for the bremsstrahlung spectrum and corrections for finite target thicknesses and collimator angles are reviewed. For the calculation of sigma sub k a simple unfolding method is proposed which is known for solving the Fredholm integral equation of the first kind, and in which the necessary smoothing of the resulting curve is derived from the mean experimental error of sigma sub q. For some examples of cross sections which may be encountered in photonuclear research above 100 MeV, the mean error of sigma sub k caused by inaccurate knowledge of the bremsstrahlung spectra, by the unfolding method and by the experimental errors of sigma sub q is calculated. Author (NSA)

N71-34834# Bhabha Atomic Research Centre, Bombay (India).
LITHIUM ISOTOPIC ANALYSIS ON RECORDING FABRY-PEROT SPECTROMETER
S. A. Ahmad and G. D. Saksena 1970 26 p refs
(BARC-508) Avail: AEC Depository Libraries

A method was developed for isotopic analysis of lithium samples by recording the isotopic structure of the lithium resonance line at 6708 A on the Recording Fabry-Perot Spectrometer using a hollow cathode source. In order to obtain the true intensity ratio of the isotopic components optimum experimental conditions were worked out. By using only 2 microgm of lithium (as Li2SO4) in the hollow cathode and exciting it at 10 mA of current, the effects due to self absorption are practically eliminated. By this method the concentration of Li-6 in a natural lithium sample was found to be 7.4 + or - 0.3%. Author (NSA)

N71-34835# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes nucleaires.
CONTRIBUTION TO THE STUDY OF NEUTRON-NEUTRON INTERACTIONS USING THE THREE NUCLEON EXPERIMENT D(n,nnp) AT 14.5 MeV: EVALUATION OF PARASITIC EVENTS [CONTRIBUTION A L'ETUDE DE L'INTERACTION NEUTRON-NEUTRON A L'AIDE DE L'EXPERIENCE A TROIS NUCLEONS D(N,NNP) A 14,5 MEV: EVALUATION DES EVENEMENTS PARASITES]
Claude Ducharme (Ph.D. Thesis - Grenoble Univ., 10 Jul. 1968) 1969 30 p refs In FRENCH
(CEA-R-3726) Avail: AEC Depository Libraries

The interpretation of the results concerning the three-nucleon experiment, D(n,nnp), at 14,5 MeV, carried out by double time-of-flight spectrometry is discussed. The main parasitic events are simulated using the Monte Carlo method for extracting them from the experimental distribution around the n-n pole. Author (NSA)

N71-34836# Atomic Weapons Research Establishment, Aldermaston (England).
ELASTIC AND INELASTIC SCATTERING OF NEUTRONS IN THE ENERGY RANGE 1.0 TO 5.0 MeV BY NATURAL MOLYBDENUM
R. E. Coles and D. Porter Dec. 1970 37 p refs
(AWRE-O-69/70; EANDC(UK)-126-AL) Avail: AEC Depository Libraries; HMSO 5s6d; BIS $1.10

Differential cross sections at ten angles from 30 to 135 deg were measured at 0.5-MeV intervals between 1.5 and 5.0 MeV for elastic scattering, inelastic scattering to groups of levels up to 1600 keV excitation in the target nucleus, and inelastic scattering to a continuum above this 1600-keV level. Excitation functions were derived from 125 deg yields measured at 0.2-MeV intervals between 1.0 and 3.0 MeV for inelastic scattering to groups of levels up to 1600 keV excitation in the target nucleus. The continuum spectra in the range 2.0 to 5.0 MeV were analyzed in terms of statistical evaporation theory and parameters describing the secondary energy distributions of the continuum scattered neutrons extracted. No attempt was made to compare the data with theoretical predictions. Moreover, above 2.0 MeV incident neutron energy, few experimental data are available with which to make comparisons, although comparisons are made where appropriate to previously evaluated cross sections. Author (NSA)

N71-34837# Illinois Univ., Urbana.
ENERGETICS, MORPHOLOGY, CRYSTALLOGRAPHY, AND THEORY OF DISPLACIVE TRANSFORMATIONS IN NEAR EQUIATOMIC NIOBIUM-RUTHENIUM ALLOYS
Bijoy Kishore Jun. 1971 168 p refs
(Contract AT(11-1)-1198)
(COO-1198-807) Avail: NTIS

The displacive phase transformations in the near-equiatomic Nb-Ru alloys were studied using magnetic susceptibility and electrical resistivity measurements, optical metallography and X-ray diffraction. Alloys containing between 41 and 45 at. % Ru undergo a CsCl to face centered tetragonal transformation on cooling to room temperature. Alloys containing more than 46 at. % Ru exhibit a two step CsCl to face centered tetragonal to face centered orthorhombic transformation on cooling to room temperature. The interphase region consists of a small volume of the crystal over which the parent phase is gradually distorted into the product phase. The associated strain energy is then reduced and the transformation shows no temperature hysteresis nor any thermal history dependence and thus the volume fraction transformed is a single valued function of temperature. The model of the transformation was developed which accounts for the variation of transformation temperatures and transformation distortions with Ru content as well as the variation of magnetic susceptibility with temperature and Ru content. Author (NSA)

N71-34838# Iowa State Univ. of Science and Technology, Ames. Engineering Research Inst.
APPLICATION OF THE MATRIX EXPONENTIAL KERNEL

Alfred F. Rohach Feb. 1971 11 p refs Presented at the Symp. on Nat. and Manmade Radiation in Space, Las Vegas, Nev. Sponsored by AEC
(COO-2060-10; CONF-710304-10; ERI-97600) Avail: NTIS

A point matrix kernel for radiation transport, developed by the transmission matrix method, was used to develop buildup factors and energy spectra through slab layers of different materials for a point isotropic source. Combinations of lead/water slabs were chosen for examples because of the extreme differences in shielding properties of the two materials.
Author (NSA)

N71-34839# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
ABOUT CALCULATING (n,2n) REACTION AMPLITUDE ON HEAVY NUCLEI. 2
V. S. Olkhovskii, E. Rekami, and S. N. Ezhov 1970 11 p refs
(ITF-70-95-E) Avail: AEC Depository Libraries

A method for solving the problem of coherent (n,2n) knock-out on heavy nuclei at low energies was developed in the approximation of infinite-mass nuclei. The Gell-Mann-Goldberger equation was used, whose nonhomogeneous term gave the T-matrix element in the DWBA. The total wave function (multiplied by the potential V sub 12 between the two neutrons) was expanded on a complete discrete set of vectors (e.g., the isotropic three-dimensional harmonic-oscillator eigenfunctions). An infinite system of equations was obtained, which was approximated to a finite system as the previous expension was shown to converge. The problem was thus reduced to solving an algebraic (instead of integral) system. The rescattering contribution was also considered.
Author (NSA)

N71-34840# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.
ON DIVERGENCES OF AMPLITUDES OF WEAK NONLEPTONIC PROCESSES WITH THE PHOTON EMISSION
B. V. Geshkenbein et al 1970 34 p refs in RUSSIAN; ENGLISH summary
(NP-18777) Avail: AEC Depository Libraries

Quadratically divergent terms in the amplitudes of nonleptonic processes with one and two photon emission as well as in the amplitudes with one virtual photon, are studied in the theory with intermediate boson. The following conclusions have been obtained: At the zero anomalous magnetic moment of W-boson: In the strong interaction SU(3) x SU(3) breaking scheme proposed previously, the weak nonleptonic amplitudes with the emission of one or two photons in G order and in the first nonvanishing approximation in e have no quadratically divergent terms. There are serious reasons to suppose that the nonleptonic amplitudes without change of parity and parity violation in Ge(2) order (without photon emission) lead to quadratically divergent expressions which cannot be eliminated by any relation between the Cabibbo angle and the parameters determining the SU(3) x SU(3) breaking. For nonleptonic processes with (delta rho meson) = 1 or delta rho meson = 0, P = -1, the result is ambiguous and quadratic divergences are possible to be absent.
Author (NSA)

N71-34841 Purdue Univ., Lafayette, Ind.
SEARCH FOR TERNARY FISSION IN Au 197, Bi 209 AND Pu 239 INDUCED BY INTERMEDIATE ENERGY He 4 IONS
Dale Lynden Uhl (Ph.D. Thesis) 1970 208 p
Avail: Univ. Microfilms Order No. 70-18759

Absolute cross sections for the formation of Mg-28 Ni-66 and Sr89 fission products and upper limits for Ca-47 and S-38 fission products were determined radiochemically. The Mg-28 cross section data and the Ca-47 upper limits have clearly indicated the existence of ternary fission in Bi-209 and Pu-239. Ternary and binary mass yield curves for Bi-209 and Pu-239 were constructed and an excitation function for the formation of Mg-28 from Bi-209 was determined from an excitation energy of 30 to 50 MeV. No evidence was found for the ternary fission of R1-201* up to an excitation energy of 45.6 Mev. Using the Mg-28 cross sections as a ternary fission monitor, ternary fission data at 35.4 and 45.6 MeV excitation energies were correlated as functions of Z-squared/A and x, the fissionability parameter. The correlation with fissionability parameter indicates a linear increase in ternary fission above x = .87 and a decrease of ternary fission probability below x = .87. The decrease of ternary fission probability has been compared with fission theory and may substantiate the present fission theory which predicts two types of saddle-point shapes.
Dissert. Abstr.

N71-34842 Maryland Univ., College Park.
EXPERIMENTAL TEST OF TIME REVERSAL INVARIANCE IN SIGMA(0) HYPERON YIELDS LAMBDA (0) HYPERON PLUS POSITRON PLUS ELECTRON
Millicent Joan Baggett (Ph.D Thesis) 1969 148 p
Avail: Univ. Microfilms Order No. 70-16019

We have analyzed 1100 events for which the sigma(0) hyperon was produced by the interaction of a stopping kaon(-) with a proton in the 30' hydrogen bubble chamber at the Brookhaven National Laboratory AGS. If time reversal invariance is violated in the electromgnetic interactions of the strongly interacting particles, the lambda(0) hyperon could be polarized along the normal to the sigma(0) hyperon decay plane. As a measurement of this polarization, we have computed the average value of the cosine of the angle between N vector and the direction of the lambda-decay proton in the lambda rest frame. For the unweighted average we find -0.032 + or - 0.017, and for the weighted average (using the magnitude of N as weight) we finr -0.030 + or - 0.027. Combining our results with the 907 events from the previous Maryland-Heidelberg-Columbia collaboration gives an unweighted average of -0.0092 + or - 0.013 and weighted average of +0.0010 + or - 0.020. This result is consistent with the absence of any T violation.
Dissert. Abstr.

N71-34843 Texas Univ., Austin.
A THEORETICAL STUDY OF THE 3 Pi g AND 1 Pi g STATES OF He2
Mary Beatrice Nelson Watson (Ph.D. Thesis) 1970 87 p
Avail: Univ. Microfilms Order No. 70-16308

Ab initio quantum mechanical calculations are made on the He2 states 3 Pi g and 1 Pi g. The calculations of these electronic potential surfaces are made first using small wave functions of nine and six terms, respectively, and then larger wave functions of 57 and 39 terms, respectively, are used. The potential curves obtained using the large wave functions are then adjusted using a semi-empirical technique. Vibrational levels and the five lowest rotational levels of each vibrational level are then fitted to both the ab initio potential curves obtained using the large wave functions and also the adjusted curves. These results are then compared with experimental values.
Dissert. Abstr.

N71-34844 California Inst. of Tech., Pasadena.
TOTAL YIELD MEASUREMENTS FOR THE Mg-24 (ALPHA,GAMMA)Si-28 AND Al-27 (P,GAMMA)Si-28 REACTIONS
Peter Bruce Lyons (Ph.D. Thesis) 1969 169 p
Avail: Univ. Microfilms Order No. 70-561

The Al-27 (p,gamma)Si-28 and Mg-24 (alpha,gamma)Si-28 reactions were investigated to provide the data needed for calculation of the Si-28 photodisintegration rate in astrophysical situations, particularly in the silicon-burning stage of stellar nucleosynthesis. The Al-27 (p,gamma)Si-28 reaction was investigated over the proton energy range 0.3 - 2.6 MeV; total gamma ray strengths were determined for 66 resonances. From 1.4 - 2.6 MeV, the gamma ray yield curve was measured and an upper limit for the nonresonant cross section was determined. The gamma-ray detection efficiencies and target purity were investigated experimentally. The reaction Mg-24 (alpha,gamma)Si-28 was investigated for alpha particle energies up to 2.8 MeV;

total gamma ray strengths were determined for 16 resonances, including a previously unreported resonance at 1.358 + or - 0.007 MeV. Stellar interaction and photodisintegration rates were calculated from the measured resonance strengths, and semi-empirical fits to these rates were determined for use in astrophysical calculations. Dissert. Abstr.

N71-34845 Indiana Univ., Bloomington.
A STUDY OF THE REACTION PION(MINUS) PROTON YIELDS PION(PLUS) PION(MINUS) PION(MINUS) PION(0) PROTON
Kyu Yul Lee (Ph.D. Thesis) 1970 126 p
Avail: Univ. Microfilms Order No. 70-14967

Approximately 95,000 usable frames of pictures were taken with the MURA hydrogen bubble chamber exposed to 6 GeV/c negative pions, at Argonne National Laboratory. About 20,000 4-prong events were scanned and measured, and 2454 events for the above reaction were selected. The cross section for the reaction is found to be 1.52 0.13 mb. The final state is characterized by an abundance of resonance production. The clean appearance of the rho(+) enhancement is worthy of note, since it is not frequently observed in this type of reaction. Enchancement of an eta-meson is also observed. The enhancement of g' (1700) in the 4-pion effective mass spectrum is not clear, due to the large background. A very clean enhancement is observed at the mass 1.26 GeV in the omega negative pion effective mass spectrum. This is identified as the B-meson. Dissert. Abstr.

N71-34846 Michigan Univ., Ann Arbor.
THE C-12(DEUTERON,ALPHA)B-10 REACTION: REACTION MECHANISM AND CLUSTER STRUCTURE
Tien-Fang Yang (Ph.D. Thesis) 1969 132 p
Avail: Univ. Microfilms Order No. 70-14689

An 83 in. cyclotron has been used to measure angular distributions from 15 deg to 165 deg for transitions to five low-lying T=0 states in B-10 at E sub d = 21.2, 25.0, and 28.9 MeV. The angular distributions show diffraction-like patterns, and some exhibit pronounced backward peaks. The excitation functions show a smooth variation with energy, and the overall features of the angular distributions are preserved. Therefore the reaction mechanism was assumed to be predominantly direct. A DWBA analysis has been carried out in which the total transition amplitude was taken as a coherent sum of a direct and an exchange amplitude. It was found that the heavy-particle-stripping part of the exchange process and its interference with the direct pick-up process is very important in reproducing the experimental angular distributions. Spectroscopic amplitudes were extracted from the DWBA analysis and compared with cluster model predictions calculated from a shell model basis. Dissert. Abstr.

N71-34847 Maryland Univ., College Park.
A STUDY OF THE (PROTON,PROTON ALPHA) AND (ALPHA,2 ALPHA) REACTIONS IN Li 6 AND Li 7 AT 60 MeV
Mahauir Jain (Ph.D. Thesis) 1969 134 p
Avail: Univ. Microfilms Order No. 70-15374

The important reaction mechanisms, especially the contribution of the quasi-free cluster knockout mechanism, at medium energies was investigated. Both the (proton, proton alpha) and (alpha, 2 alpha) reactions on Li-6 and Li-7 were studied at about 60 MeV. The energy and angular correlations were obtained by measuring the energies of the two outgoing particles in coincidence. For each reaction one set of quasi-free angles, as theta sub 1 and theta sub 2 such that it is kinematically possible to leave the residual nucleus at rest, was included. The analysis of the knock-out reactions was performed within the framework of the impulse approximation. The theoretical momentum distributions were derived from the cluster model wave function for Li-6. For Li-7 an analytic expression for l = 1 was used. The impulse approximation for the cluster knock-out reaction seems to be fairly good for the (proton, proton alpha) reactions. For the (alpha, 2 alpha) reactions the effects of the off-energy-shell matrix element and multiple scattering are found to be significant. Dissert. Abstr.

N71-34848 Maryland Univ., College Park.
THE VECTOR-AXIAL VECTOR CURRENT RATIO IN THE DECAY SIGMA(MINUS) HYPERON YIELDS NEUTRON ELECTRON NEUTRINO
Robert Edward Knop (Ph.D. Thesis) 1969 105 p
Avail: Univ. Microfilms Order No. 70-14942

An experiment to measure the magnitude of the ratio of vector to axial vector coupling in the weak decay sigma(minus) hyperon yields neutron. The analysis is based on an exposure of 550,000 frames of K stopping in the 30' Brookhaven National Laboratory hydrogen bubble chamber. The determination of the vector to axial vector ratio required the identification of np scatters associated with the sigma(minus) hyperon yields neutron decay. The results of this experiment are favorable for the SU3 based model of Cabibbo. Dissert. Abstr.

N71-34849 Syracuse Univ., N.Y.
THE MAGNITUDE OF THE KAON(0) SUB L KAON(0) SUB S MASS DIFFERENCE AND LAMBDA HYPERON PROTON INTERACTIONS AT HIGH ENERGIES
Daniel Anthony Bassano (Ph.D. Thesis) 1969 66 p
Avail: Univ. Microfilms Order No. 70-15204

The neutral antikaon beam was obtained from negative kaon proton interactions in the hydrogen bubble chamber. The time dependence of neutral antikaon interactions coming from a pure neutral antikaon beam at t = 0 was analyzed to determine the kaon mass difference. The result is in good agreement with less accurate measurements using a similar technique as well as with more accurate measurements using different techniques. Secondly a Lambda hyperon beam produced form negative kaon proton interactions was studied and cross sections were determined in the Lambda hyperon momentum range of approximately 1-5 GeV/c. The elastic and total cross sections averaged over the full energy range are found to be approximately 10 mb and 35 mb, respectively. These values are in good agreement with predictions of various versions of the quark model. Also observed were final state resonance production and these are discussed in terms of meson exchange models. Dissert. Abstr.

N71-34850 Carnegie-Mellon Univ., Pittsburgh, Pa.
THE ELECTROMAGNETIC SIZES AND SHAPES OF Ba 136,137,138, La 139, Ce 140,142, Pr 141 AND Nd 142 NUCLEI FROM MUONIC X-RAYS
Albert Charles Thompson (Ph.D. Thesis) 1969 95 p
Avail: Univ. Microfilms Order No. 70-17147

The muonic x-rays of Ba-136, 137, 138, La-139, Ce-140, 142, Pr-141, and Nd-142 were measured with a high resolution Ge(Li) detector. The Ba-136, 137, 138 and Ce-140, 142 isotope shift of the K(2P-1S) lines were measured. The magnetic hyperfine splitting parameter, A1(1S1/2), of La-139 and of Pr-141 were found to be 1.21 + or - 0.09 keV and 1.52 + or - keV respectively. The quadrupole moments of Ba-137, La-139, and Pr-141 measured from 2P3/2-1S1/2 hyperfine structure were found to agree with results from other techniques. The Fermi charge distribution parameters, C sub 0 and t, were measured for Ba-128, La-139, Ce-140, Pr-141, and Nd-142. The skin thickness parameter, t, was found to increase from t=2.11 + or - 0.15 F for Ba-138 to t=2.34 + or - 0.07 F for Nd-142. The N=82 isotone shift was measured to be about 1.63 times the shift expected with a uniform charge distribution. The staggering parameter for the isotones La and Pr was measured to be about 0.8. Dissert. Abstr.

N71-34851 Washington State Univ., Pullman.
ELECTRON-IMPACT DESORPTION OF CARBON MONOXIDE FROM TUNGSTEN: ION ENERGY DISTRIBUTIONS
Lawrence Evan Davis (Ph.D. Thesis) 1970 59 p

Avail: Univ. Microfilms Order No. 70-16802

Energy distributions of electron-impact desorbed ions from a tungsten ribbon were shown to arise from four well known carbon monoxide surface states. Correlation of the ion current with the rate of neutrals released during thermal desorption has revealed that 1.0 eV ions were released from the virgin state, 2.0 eV ions from the alpha state, 6.7 eV ions from the beta 1 state, and 7.1 eV ions from the beta 2 and/or beta 3 state(s). A model for the conversion of the virgin state to the beta states was presented for the temperature range of 250 K to 400 K. The effects of continuous electron bombardment during the adsorption of carbon monoxide was also reported.

Dissert. Abstr.

N71-34852 Florida Univ., Gainesville.
A NUCLEAR RELAXATION STUDY OF MOLECULAR MOTION IN LIQUID AND SOLID AMMONIA
James Lynn Carolan (Ph.D. Thesis) 1969 169 p
Avail: Univ. Microfilms Order No. 70-14861

A NMR investigation of the modes of molecular motion in ammonia was made in the temperature range from approximately 1 to 239.8 K. Proton spin-lattice relaxation time (T) was measured in the solid phase from 65 to 195.4 K at fields of 2.56, 3.87, 4.88, and 8.22 kG. All T curves exhibited a single minimum ranging from 4.5 msec at 2.56 kG to 10 msec at 8.22 kG. The experimental data were well fit by the Hilt-Hubbard theory which relates T to stochastic hindered rotation of an equilateral triangular configuration of spin 1/2 nuclei about the C3 axis. The activation energy for C3 rotation was assumed temperature independent and calculated to be 2.30 + or - 0.02 kcal/mole. The neutron diffraction measurement of intramolecular proton separation (1.651 A) was corroborated by out T measurements. A CW proton lineshape study was made at 1.7 kG from approximately 1 to 195.4 K, and the linewidth and second moments were calculated. The theoretical second moments, through third nearest neighbor intermolecular protons, was calculated to be 46.1sq. G using lattice parameters found from neutron diffraction work on ND3 at 77 K. Dissert Abstr

N71-34853 Ohio Univ., Athens.
A MODEL OF NUCLEAR PHOTOFISSION
William Edward Updegraff (Ph.D. Thesis) 1969 119 p
Avail: Univ. Microfilms Order No. 70-15293

The process of symmetric binary photofission was investigated by applying the dynamic collective model to the extremely deformed nuclear shapes that exist during any fission process. The dynamic collective model used consisted of a combination of the Steinwedel-Jensen photonuclear model and the Bohr-Wheeler liquid drop model. The nuclear system was described by a single parameter surface before separation of the fragments and by the fragment separation distance after separation was achieved. The charge density oscillation eigenfrequencies were calculated by using partial wave solutions, applying the surface boundary conditions, expanding by associated polynomials, expressing the results in terms of matrices, and searching for solutions by computer techniques. Using similar techniques, the mass parameter and moment of inertia were determined in order to describe surface motions. Ultimately cross-sections were calculated using standard perturbation theory in the electric dipole approximation.

Dissert Abstr.

N71-34854 Yale Univ., New Haven, Conn.
A STUDY OF SOME EVEN ISOTOPES OF NEODYMIUM BY ELECTRON SCATTERING
David William Madsen (Ph.D. Thesis) 1969 140 p
Avail: Univ. Microfilms Order No. 70-16306

An electron accelerator was used to study the ground state charge distributions and properties of some low lying states in Nd-142, Nd-146, and Nd-150. The incident electron energy was varied between 15 MeV and 60 MeV and angular distribution measurements were made at angles between 70 and 150 deg. If the charge distribution is described in terms of a half-density radius c and a skin thickness t, the present results indicate anomalously small values of t in all three neodymium isotopes. A comparison with the effect of dispersion corrections on the interpretation of muonic X-ray results suggests that similar corrections are needed in the present case. Reduced gamma transition probabilities and transition radii are presented for some low-lying levels.

Dissert. Abstr.

N71-34855 Yale Univ., New Haven, Conn.
PHOTODISINTEGRATION OF DEUTERIUM: ABSOLUTE CROSS SECTION AND ANGULAR DISTRIBUTION
Barry Weissman (Ph.D. Thesis) 1969 186 p
Avail: Univ. Microfilms Order No. 70-17224

Absolute differential cross sections were measured for the D(gamma,p) reaction in the photon energy range from 28 to 55 MeV at seven laboratory angles between 30 deg and 150 deg. Bremsstrahlung was produced by a 60 MeV electron beam. The Schiff thin target bremsstrahlung spectrum, integrated over all angles of photons and incident electrons, was assumed. Photoprotons from gas target were detected in thick lithium drifted silicon counters. Measured angular distributions were fitted with sums of Legendre polynomials and the results are compared with the calculations of Partovi. At 35 MeV the measured total cross section is in excellent agreement. At lower energy the total cross section is somewhat below calculated values, while above 35 MeV it is higher. The measured angular distribution is more asymmetric (forward peaked) than calculations predict.

Dissert. Abstr.

N71-34856 Michigan State Univ., East Lansing.
SPECTROSCOPY IN THE TITANIUM ISOTOPES VIA (p,d) AND (p,t) REACTIONS
Phillip James Pleuger 1969 86 p
Avail: Univ. Microfilms Order No. 70-15111

Deuteron angular distributions from Ti-48(p,d)Ti-47 were measured at incident proton energies of 24.80, 29.82, 35.15, 39.97 and 45.05 MeV to detect the presence of any energy dependence in various methods of extracting spectroscopic factors. Using optical parameters obtained from the literature, distorted wave Born approximation calculations were performed with the Oak Ridge code JULIE for the principal L sub n = 1,2 and 3 transitions observed. In all cases, significantly better agreement with the data was obtained in the zero-range approximation by using a lower integration cutoff at the nuclear surface. The variation of spectroscopic factors with cutoff radius also exhibited a plateau at the nuclear surface; however energy dependence of extracted spectroscopic factors was still present. The best agreement was obtained by applying finite range and non-locality corrections to the form factors used by JULIE. No integration cutoffs were required and energy dependence was removed.

Dissert. Abstr.

N71-34857 Michigan State Univ., East Lansing.
A STUDY OF THE ENERGY LEVELS OF Ne 18, Mg 22, Si 26, S 30, Ar 34, AND Ca 38 BY THE (p, t) REACTION
Robert Alton Paddock 1969 171 p
Avail: Univ. Microfilms Order No. 70-15069

A study of the (p,t) reaction on the even-even N = Z nuclei in the 2s1d shell has been carried out. The reaction has been used to study the energy levels of Ne-18, Mg-22, Si-26, S-30, Ar-34, and Ca-38. Until recently little has been reported about these nuclei. Except for a few scattered reports of (p,t) experiments, only the (He-3,n) and (He-3,ngamma) reactions have been used to study these nuclei. The excited states that were observed are reported along with the spin and parity assignments when possible. The two nucleon transfer distorted wave theory has been studied with respect to these (p,t) reactions. It was found that the shapes of the predicted angular distributions are primarily dependent on the orbital angular momentum transfer and the optical model parameters. This fact was used to make the spin-parity assignments. It was also found that the magnitudes of the predicted cross sections are strongly dependent on not only the optical model parameters, but also

the bound state parameters of the transferred neutrons and the configuration mixing in the initial and final nuclear wave functions. Dissert. Abstr.

N71-34858 City Univ. of New York.
NUCLEAR REACTIONS OF C 12, Ne 20, AND Ar 40 INDUCED BY 14 MeV NEUTRONS
Stanley Kardonsky (Ph.D. Thesis) 1970 72 p
Avail: Univ. Microfilms Order No. 70-19550

A gridded ionization chamber was used to study neutron induced reactions, in situ, of C-12, Ne-20, and Ar-40. Cross sections were calculated for these reactions to various energy levels in the product nuclei, utilizing the C-12(n,alpha sub 0) Be-9 reaction as a neutron flux standard. Experimental cross sections for Ar-40 and Ne-20 were compared with theoretical and semiempirical predictions. The data indicated that all the above reactions proceed via direct mechanisms. A hypothesis as to the mechanism of the Ne-20(n,2 alpha) reaction is presented which suggests the reaction proceeds via two competing mechanisms. Dissert. Abstr.

N71-34859 Michigan State Univ., East Lansing.
MODEL DEPENDENCE OF THE BINDING ENERGY OF NUCLEAR MATTER
Michael David Miller (Ph.D. Thesis) 1969 84 p
Avail: Univ. Microfilms Order No. 70-15086

The feasibility of using nuclear matter calculations to distinguish between potentials which cannot be distinguished through two-nucleon elastic scattering experiments is investigated. Using the method described by Brueckner and Masterson for the static potentials and, with modifications, for the momentumdependent potentials, the mean binding energy per nucleon in nuclear matter is calculated for each of the S, P, and D states using several phenomenological two-nucleon potentials which have identical on-energy-shell matrix elements. The binding energy is found to be very sensitive to the form of the short range repulsion in the potential. Replacing a hard core potential by a short range momentum-dependent, one having identical on-energy-shell matrix elements is found to increase the contribution of the S and P states to the binding energy of nuclear matter. There was little change in the contribution of the D states. With the proper form for the momentum dependence, increases in the binding energy of over 12 MeV per particle were obtainable. Dissert. Abstr.

N71-34860 Minnesota Univ., Minneapolis.
EQUIVALENT POTENTIALS FOR PION-ALPHA SCATTERING
Lawrence Joseph McDonald (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms Order No. 70-15775

A theoretical investigation of pion-nucleus scattering was made using a two-body direct interaction model. The potential is a sum over the scattering from each bound nucleon. Shell model wave functions describe these nucleons while the impulse approximation is used to replace bound nucleon scattering with a free nucleon scattering matrix calculated off its energy shell. The resultant equivalent potential is both nonlocal and energy dependent. Numerical calculations were made for the special case of pion-alpha scattering at 24 MeV. The equivalent potential is found to be attractive in both the S and P partial waves. Experimental evidence indicates the S-wave potential should be repulsive. This disagreement points out the need to suppress the P sub 33 partial wave for strongly bound nucleons and suggests the free nucleon scattering matrix does not adequately represent scattering from bound nucleons. Taking nucleon correlations into account is a possible way of eliminating this disagreement. Dissert. Abstr.

N71-34861 Harvard Univ., Boston, Mass.
KINEMATICS AND DYNAMICS OF REACTIVE COLLISIONS
Peter Emil Siska (Ph.D. Thesis) 1970 317 p
Avail: Univ. Microfilms Order No. 70-18340

Crossed molecular beam experiments with velocity analysis of the alkali chloride products from the reactions of K, Rb, and Cs with CCl4 are described. A strong coupling exists between the center-of mass (c.m.) angular distributions of the products and the speed with which they recoil away from the c.m. The kinematic methods are developed and applied to other reactions for which product velocity spectra have been measured. Angular distribution measurements on the alkali atom products from the reactions of hydrogen and deuterium atoms with alkali halide molecules are reported. Pronounced anisotropies and chemical trends may be partially due to molecular orientation effects. Potential energy surface calculations based on a one-electron pseudo-potential model for the entrance channel of these reactions show pronounced wells for a triangular configuration of the atoms and more or less repulsive interactions for other geometries. A concerted electron transfer in a definite preferred geometrical configuration may govern these reactions. Dissert. Abstr.

N71-34862 Carnegie-Mellon Univ., Pittsburgh, Pa.
TWO-NUCLEON REACTION MATRIX OFF THE ENERGY-SHELL
Susanta Kumar Mukhopadhyay (Ph.D. Thesis) 1970 117 p
Avail: Univ. Microfilms Order No. 70-17143

Assuming definite high energy behaviors for the phase shifts and a particular one-parameter functional form for some preliminary reaction matrix calculations were done for nuclear matter and finite nuclei. The results are fairly insensitive to the high-energy behavior of the phase shifts as expected. However, the off-shell behavior appears to be as important as the consideration of higher order diagrams in the many-body theory. Dissert. Abstr.

N71-34863 Michigan Univ., Ann Arbor.
THE DECAY SCHEMES OF Ba 131 AND Ir 192 NUCLEI
Sabrina V. J. Lin Lee (Ph.D. Thesis) 1969 166 p
Avail: Univ. Microfilms Order No. 70-14578

In studying the electron capture decay of Ba-131 to levels in Cs-131, energy and relative intensity measurements were performed on 36 gamma-rays with a 4-cc Ge(Li) detector. New transitions at 797 keV and 954 keV were observed. Precision energy determinations were made for the four strongest transitions using a 2-meter curved-crystal spectrometer. In studying the beta decay and electron capture decay of Ir-192 to levels in Pt-192 and Os-192 21 gamma transitions were observed, including new transitions at 110 keV, 177 keV and 280 keV. Energy and relative intensity measurements were made using a 17 cc and a 40 cc coaxial Ge(Li) detector. Precision curved-crystal gamma-ray energy determinations were made for 19 gamma transitions. Upper intensity limits are given. The singles and coincidence results confirm the presently established decay scheme. Dissert. Abstr.

N71-34864 Yale Univ., New Haven, Conn.
A STUDY OF LIGHT RIGID ROTOR NUCLEI
Richard Arthur Lindgren (Ph.D. Thesis) 1969 346 p
Avail: Univ. Microfilms Order No. 70-16297

A study was made of four similar, strongly deformed, prolate nuclei in the odd count Zeta = 11 nuclear multiplet. New angular momentum quantum numbers and electromagnetic de-excitation properites were determined for levels and transitions in Na-21 and Na-23 nuclei. The data together with works of others were systematically examined by comparing model predictions based on the rotor, Coriolis, and shell models with experiment for the Na-21, Na-21, Na-23, and Mg-23 odd count Zeta = 11 nuclei. It was determined from the comparisons that the rotor and Coriolis model predictions of excitation spectra, electric quadrupole and magnetic dipole reduced transition probabilities in the K=3/2+ ground state rotational band in the Zeta = 11 nuclei are in better agreement with experiment than the shell model results. Further, the Coriolis results including other single particle configurations

reproduce the magnetic dipole transitions matrix elements better than the pure rotor model calculation. Dissert Abstr.

N71-34865 Cornell Univ., Ithaca, N.Y.
PROJECTION OF GAS PHASE ELECTRON DIFFRACTION PATTERNS: DEVELOPMENT OF A NEW TECHNIQUE
Mark Joseph Cardillo (Ph.D. Thesis) 1970 125 p
Avail: Univ. Microfilms Order No. 70-17461

The general features and operation procedure of the electron diffraction apparatus on the projection (parallel) mode is described. The optical behavior is tested via Debye-Scherrer patterns of ZnO and gas phase photographs. The relative independence for the projected pattern of sample spreading is demonstrated, as well as contrast higher than conventional gas phase photographs. This mode of operation is used to experimentally determine the carbon scattering factor using the differences of ratios of observed molecular intensities. The source of the scatter is discussed and proposals are made for its elimination. Dissert. Abstr.

N71-34866 Purdue Univ., Lafayette, Ind.
TWO STUDIES IN QUANTUM CHEMISTRY: PART 1: INVERSION BARRIERS AND THEIR ORIGINS IN NH3 AND PH3. PART 2: SELF CONSISTENT FIELD CALCULATIONS OF SELECTED ELECTRONIC PROPERTIES FOR THE SERIES OF OCTAHEDRAL CLUSTERS TiO6(MINUS x)
Peter Meyer Castle (Ph.D. Thesis) 1970 200 p
Avail: Univ. Microfilms Order No. 70-18611

Two discussions, the direct evaluation of the inversion barrier energies in ammonia and phosphine molecules and octahedral transition metal oxide clusters of the general formula TiO6(minus x), are presented. Part one utilizes the one electron nuclear attraction integrals and the SCF wave functions for the pyramidal and planar conformations of the systems. An interaction operator is defined from the pertinent molecular model. It is then employed in the calculation of the barrier energies from both scaled and unscaled wavefunctions in the one center expansion approximation for NH3 and PH3. Barrier heights of 0.00172 a.u. and 0.03023 a.u. were obtained by this method from ammonia and phosphine respectively. Part two was carried out in the self-consistent-field formalism for the valence shell orbitals utilizing a core-corrected Hamiltonian operator to account for interactions with inner-shell electrons. Comparisons of the results for a model in which ligand overlap is neglected with a model in which these effects are explicitly represented show that their inclusion is necessary for clusters with relatively short internuclear distances. Dissert. Abstr.

N71-34867 Washington Univ., Seattle.
VIBRATIONAL ENERGY TRANSFER IN THERMAL UNIMOLECULAR SYSTEMS
Siu Cheung Chan (Ph.D. Thesis) 1970 129 p
Avail: Univ. Microfilms Order No. 70-19617

The thermal isomarization of methyl isocyanide was studied at 280.5 C in the presence of 101 different bath gases. From a systematic study of the inert gas effect on this system by the members of the homologous series of n-perfluoroalkanes and n-nitriles, relative collision diameters of these molecules, appropriate for the phenomenon of vibrational energy transfer involved were obtained. The thermal methyl isocyanide-helium system was studied at five different temperatures over a range of 115 C. A lowering of the apparent activation energy by 1.1 kcal/mole was observed. This is in accordance with the prediction of theoretical calculations that the intrinsic collisional efficiency should decrease with rise in temperature. A comprehensive study of the inert gas effect of the 101 bath molecules provides further evidence for the view that vibrational energy transfer at high energy levels of complex substrate molecules is a quasi-statistical redistribution of internal energy of the collision complex. Dissert. Abstr.

N71-34868 Rochester Univ., N.Y.
QUANTUM MECHANICAL TREATMENT OF ENERGY TRANSFER IN NONREACTIVE COLLINEAR COLLISIONS AND THE DYNAMICS OF AN ANHARMONIC OSCILLATOR
Agnes Shan Cheung (Ph.D. Thesis) 1970 237 p
Avail: Univ. Microfilms Order No. 70-17867

The vibrational transition probabilities of atom-diatomic collinear collisions are treated. The diatomic molecule is represented by a harmonic oscillator. The total wave equation of the colliding system is solved exactly in the cases of step potential and linear potential. Smooth transition probability versus energy curves are observed for linear potentials. The step and linear approximations provide effective methods for studying the transition probabilities of realistic interaction potentials. The transition depends on the slope of the interaction potential. Diatomic-diatomic non-impulsive collinear collisions are considered by means of the linear potential and the step approximation. The dynamics of a cubic anharmonic oscillator is studied by the linear variation method and by second order perturbation theory. The time evolution of an analogous classical ensemble of cubic oscillators was also evaluated and compared with the quantum results. Dissert. Abstr.

N71-34869 Iowa Univ., Iowa City.
A STUDY OF LI6 PLUS CL2 REACTIONS AT BOMBARDING ENERGIES FROM 9.0 TO 14.0 MeV
David John Johnson (Ph.D. Thesis) 1970 212 p
Avail: Univ. Microfilms Order No. 70-15608

Yield curves were measured for protons, deuterons, and alpha particles at laboratory angles of 0 deg and 40 deg, at Li-6 bombarding energies from 5.6 to 14.0 MeV. Angular distributions were also measured. An interpretation of the accumulated alpha particle data in terms of two-mode plane wave and single-mode distorted wave direct reaction theories is suggested. The proton, deuteron, and alpha particle data corresonding to individual states of the residual nuclei were compared to Hauser-Feshbach-averaged angular distributions. An Ericson fluctuation analysis was made of the yield curve. An angular cross correlation analysis of the angular distributions gives a coherence angle of 15 deg to 20 deg for protons and 14 deg to 16 deg for alpha particle groups. Dissert. Abstr.

N71-34870 Yale Univ., New Haven, Conn.
STRUCTURE OF THE sd SHELL NUCLEI
Richard George Hirko (Ph.D. Thesis) 1969 191 p
Avail: Univ. Microfilms Order No. 70-16282

A study of the sd shell nuclei has been undertaken to examine, and hopefully determine, the systematic evolution of the shape and other characteristic signatures of collectivity throughout the shell. Particular emphasis has been placed on the study of the mass 29 nuclei, Al-29 and Si-29, in the region of the possible transition from prolate to oblate configurations. In addition to direct reaction studies, the beta decay of Al-29 was utilized in a search for states in Si-29 having similar shape to that of the Al-29 ground state and in developing a consistent interpretation of the low levels of Si-29. The experimental data concerning Al-29 were considered within the framework of the Nilsson strong coupling model and the Coriolis coupling model developed by Malik and Scholz. From these experimental data an overall picture of the evolution of nuclear shapes throughout the sd shell has been developed. Dissert. Abstr.

N71-34871 Kentucky Univ., Lexington.
STUDY OF (PION,NEUTRON) REACTIONS IN V-51 AND Zn-68
James Joseph Egan (Ph.D. Thesis) 1969 154 p
Avail: Univ. Microfilms Order No. 70-16970

Two pairs of isobaric analog resonances near 4.1 and 4.9 MeV proton bombarding energy respectively have been studied in the Zn-68(p,n)Ga-68 reaction. Eleven levels in Ga-68 up to an excitation energy of 1.088 MeV were identified in time-of-flight spectra. Hauser-Feshbach analyses were done on the angular

distributions of neutrons leaving Ga-68 in 4 and 6 residual nucleus states at 4.400 and 4.512 MeV respectively, an energy region where no analog resonances appear. The 2.335 MeV isobaric analog resonance in V-51(p,n)Cr-51 and V-51(p,p)V-51 was analyzed according to the Robson theory. A negative resonance mixing phase was required to fit the resonance in the proton elastic scattering data. This corresponds to a positive level shift when fitting the resonance in the (p,n) data. V-51(p,n)Cr-51 angular distributions at 4.013 and 5.016 MeV bombarding energies were analyzed via the Hauser-Feshbach formalism. Dissert. Abstr.

N71-34872 Brigham Young Univ., Provo, Utah.
SPIN AND PARITIES OF THE 15 keV AND 1726 keV RESONANCES IN THE A1-27(PROTON, GAMMA)Si-28 REACTION
Peter Ballard Snow (Ph.D. Thesis) 1970 132 p
Avail: Univ. Microfilms Order No. 70-15694

Spins and parities of resonance at 13047 KeV and 13252 KeV in 28Si were studied. These were created at a proton energy of 1514 KeV and 1726 KeV respectively. Theoretical angular distributions for the first and second gamma rays from resonance were compared with the experimental angular distributions obtained from two million volt Van de Graaff facility. A value of 2(-) is assigned to the 1514 KeV resonance, and 5(-) is assigned to the 1726 KeV resonance. Dissert. Abstr.

N71-34873 Toledo Univ., Ohio.
DYNAMIC STUDIES OF THE OPTICAL ABSORPTION ASSOCIATED WITH TRAPPED ELECTRONS
Robert J. Bieringer (Ph.D. Thesis) 1969 94 p
Avail: Univ. Microfilms Order No. 70-15561

Studies of electron traps in fused silica, populated via X-irradiation, are reported. Silica was doped with Tb, Tm, and Dy, in order to measure thermoluminescence, correlated with the radiation-induced optical absorption. The traps were found to be host-associated. The absorption spectrum was obtained both under static and dynamic conditions for which, in addition to thermal broadening, the densities of populated traps change with time. The dynamic measurements were made using a rapid-scan monochromator, designed to obtain the spectrum in 1 millisecond. The results demonstrated the existence of a redistribution of electrons among the traps at elevated temperatures, implying the existence of nonlocalized intermediate states. The possibility of extremely shallow traps was considered and an optical selection rule was derived assuming periodicity. This was investigated experimentally and the null result imposed a lower limit of 0.25 eV on the depth of the traps.
Dissert. Abstr.

N71-34874 Indiana Univ., Bloomington.
ANISOTROPIC ENERGY GAP, PHONON CONTRIBUTION TO THE EFFECTIVE MASS, AND ELECTRICAL RESISTIVITY OF WHITE TIN
James Frank Balsley (Ph.D. Thesis) 1970 123 p
Avail: Univ. Microfilms Order No. 70-14958

The pseudopotential model for the electron-phonon interaction was used to calculate the electrical resistivity, phonon part of the electron effective mass as a function of position on the Fermi surface, and the anisotropic superconducting energy gap in white tin. Both a Born-von Karman model and a pseudopotential model for the lattice dynamics were used to obtain the phonon polarization vectors and eigenvalues. The electron-phonon matrix elements were calculated between two-OPW states for umklapp processes and between one-OPW states for normal processes. Both components of the resistivity were calculated from 10 K to 373 K. The results were not sensitive to the phonon model and agreement with experiment was satisfactory. The phonon contribution to the effective mass enhancement of the cyclotron mass relative to the band structure mass was calculated at various points on the Fermi surface. The anisotropic energy gap was also calculated.
Dissert. Abstr.

N71-34875 Carnegie-Mellon Univ., Pittsburgh, Pa.
PARTICLE AND COLLECTIVE NATURE OF THE STATES IN Sr 86
Melvin H. Friedman (Ph.D. Thesis) 1969 223 p
Avail: Univ. Microfilms Order No. 70-17140

Inelastic alpha differential cross section angular distributions were obtained for five of the excited states of Sr-86. From these measurements deformation parameter and parity measurements are made. Fractionization of the octupole states was observed and comparison is made with Veje's theory. The systematic behavior of the principal octupole state has been extended to include the Sr-86 nucleus. Sr-87(d,t) cross section angular distributions were obtained for thirteen of the states in Sr-86. From these measurements spectroscopic factors and parity measurements are made for the Sr-86 nucleus. Evidence is found which supports the assumption that the neutron two-hole interaction in Sr-86 is the same as the proton two-particle interaction in Zr-90. The location of the neutron 1gg/2, 2p1/2, 2ps/2 and 1f5/2 single-particle energies is measured.
Dissert. Abstr.

N71-34876 Clemson Univ., S.C.
A NUMERICAL ANALYSIS OF THE INELASTIC SCATTERING OF NUCLEONS FROM LITHIUM-SEVEN
Donald Eugene Kinkaid (Ph.D. Thesis) 1969 57 p
Avail: Univ. Microfilms Order No. 70-17448

A numerical analysis of the inelastic scattering of nucleons from Li7-was performed using the set of potentials defined by the structure calculations. The distorted wave Born approximation was used to calculate the differential inelastic scattering cross section. The scattering states were combinations of coulomb distorted waves and the bound shell model states which were defined by the structure calculations cited above. The j-j coupling scheme was used throughout the calculations. The strength and range parameters of the potentials were varied to determine whether or not the potentials could be used to obtain descriptions of both structure and scattering. The results of the calculations indicate that the two-body forces between the positive energy nucleon and the bound nucleons is considerably stronger than the two-body forces between the bound nucleons. Apparently, realistic necleon-nucleon interactions should be used for scattering calculations. Dissert. Abstr.

N71-34877 Pennsylvania Univ., Philadelphia.
A PARTICLE GAMMA RAY ANGULAR CORRELATION STUDY OF Ni-57 USING THE REACTION Ni(He-3,ALPHA GAMMA)Ni-57
Christopher Robert Gould (PH.D. Thesis) 1969 113 p
Avail: Univ. Microfilms Order No. 70-16153

The levels of Ni-57 populated in the reaction Ni-58(He-3, alpha gamma) Ni-57 were studied using the method of particle gamma-ray angular correlations. A 500 Mugm/cm2 nickel foil enriched to 99.9% Ni-58 was bombarded with 15 MeV He-3(++) beam, from the Tandem accelerator. The alpha particles were located at zero degrees with respect to the incident beam by a position sensitive detector located at the focal point of a magnetic spectrometer. Four 7.6 cm x 10.2 cm NaI (tl) crystals were simultaneously used to detect coincident gamma-rays at angles between 90 degrees and 180 degrees. Branching ratios for the decays of these levels are presented, along with mixing ratios for the stronger transitions.
Dissert. Abstr.

N71-34878 Washington Univ., Seattle.
AB INITIO CALCULATION OF THE ELECTRON AFFINITIES OF SOME OF THE ATOMS OF THE FIRST ROW
Parker Kirk Ashurst (Ph.D. Thesis) 1970 59 p
Avail: Univ. Microfilms Order No. 70-19611

Ab initio calculations of the electron affinities of lithium, boron, oxygen, and fluorine are presented, with estimates of the electron affinities of carbon and nitrogen. In addition, a new formulation of the self-consistent field equations for multiple open shells is described, along with a critical analysis of existing formulations. Dissert. Abstr.

N71-34879 Indiana Univ., Bloomington.
A CONFIGURATION INTERACTION CALCULATION ON THE GROUND STATE OF THE BeH2 MOLECULE
Richard Pierce Hosteny (Ph.D. Thesis) 1970 137 p
Avail: Univ. Microfilms Order No. 70-17955

A configuration interaction calculation is carried out on the ground state of the beryllium hydride molecule, BeH2, using a nonorthogonal one-electron basis of elementary symmetry orbitals formed from real Slater-type orbitals centered on the nuclei. A number of different atomic-orbital basis sets are used, ranging in size from a minimal basis of four up to a final set of twenty-one orbitals. For this final basis, an optimized 80-term wavefunction gives a calculated groundstate energy of -15.8478 Hartrees (H) at an equilibrium bond distance of 2.52 bohrs. Based on the results of these calculations, the contributions to the total correlation energy of the molecule are estimated to be: 0.042 H for the inner shell, 0.092 H for the valence shell, and 0.008 H for inter-shell effects. These values lead to an estimate of -15.915 H for the total nonrelativistic ground-state energy of BeH2. Dissert. Abstr.

N71-34880 Kansas State Univ., Manhattan.
A MODEL FOR ELECTRONIC STOPPING POWER OF HEAVY IONS
Glen Patrick Reese (Ph.D. Thesis) 1970 109 p
Avail: Univ. Microfilms Order No. 70-16643

A theoretical model for the electronic stopping power S(e) for heavy ions is proposed. The Hartree-Fock-Slater description of the atom is used. Two sets of calculations are presented, where the only difference is the inclusion of contributions of all orbital electrons, compared with a scheme selectively using only outer shell contributions. A criterion is proposed for the selection of participating subshells. The calculations exhibit an oscillatory structure in S(e) as a function of projectile atomic number. These results are compared with experiment for amorphous carbon and nitrogen gas targets. The calculated energy loss of the projectile is presented as a function of the distance of closest approach in a two-atom collision. The one-parameter wave functions underestimate the average electron velocity when the radial wave function has nonzero nodes. Dissert. Abstr.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-34881*# California Univ., Los Angeles. Dept. of Physics.
ION ACOUSTIC WAVES IN A MULTI-ION PLASMA
Burton D. Fried, Roscoe B. White, and Thomas K. Samec Jan. 1971 11 p refs Sponsored in part by NASA, ONR, NSF, and AEC
(NASA-CR-121721; AD-720773; r-86) Avail: NTIS CSCL 20I

An exact treatment of the multi-species ion acoustic dispersion relation is given for an argon/helium plasma. Phase velocity and damping are obtained as a function of ion-electron temperature ratio and relative densities of the two species. There are two important modes in the plasma, with quite different phase velocities in general, which are referred to as principal heavy ion mode and principal light ion mode. Which of these is dominant depends on the relative densities of the two components, but in general the light ion mode becomes important for surprisingly small light ion contamination. Approximate analytic expressions are derived for damping rates and phase velocities and their domains of validity are investigated. Relevance of the results for the investigation of collisionless shocks is discussed. Author

N71-34882*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy
THE EXCITATION OF ION BURSTS FROM GRIDS
George Knorr Apr. 1970 14 p refs
(Grant NGL-16-001-043; Contract AT(11-1)-2069)
(COO-2059-4; Rept-70-19; NASA-CR-121738) Avail: NTIS CSCL 20I

Experiments on ion bursts with a step function excitation of a grid are investigated theoretically. After the description of particle distributions and potentials in the sheath region, the ideal response of a probe located at a distance from the grid is calculated. It is shown how the declining part of the response function depends on the sheath characteristics. It is estimated that it should not be impossible to measure directly the far field of test particles in the initial part of the response function. Author (NSA)

N71-34883# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
DYNAMIC STABILIZATION OF THE DRIFT-DISSIPATIVE INSTABILITY USING AN INHOMOGENEOUS HF FIELD [STABILISATION DYNAMIQUE DE L'INSTABILITE DE DERIVE DISSIPATIVE PAR UN CHAMP HF INHOMOG ENE]
D. Lepechinsky, P. Rolland, and J. Teichmann Jan. 1971 13 p refs In FRENCH
(EUR-CEA-FC-581; DPh-PFC/SIGN) Avail: AEC Depository Libraries

A method of stabilizing dissipative-drift instability in a partially ionized plasma is studied. The method involves a HF electric field parallel to the static magnetic field, by presenting a gradient in the radial direction of the cylindrical plasma column. The dispersion equation is obtained using the two-fluid macroscopic equations with scalar pressure. It is shown that better stability is obtained than with a homogeneous high-frequency field, in particular for a field frequency superior to the collision frequency; this stability can be obtained with relatively low electric field strengths. NASA

N71-34884# Institute of Nuclear Research, Warsaw (Poland).
EFFECTS OF LEAKAGE CURRENTS TO GROUND IN AN MHD GENERATOR WITH UNIFORM GAS [WPLYW PRADOW UPLYWU DO ZIEMI NA PRACE GENERATOR MAD ZE STALYMI PARAMETRAMI GAZU]
Z. Celinski 1971 17 p ref
(INR-1242) Avail: AEC Depository Libraries

Expressions are derived that determine the effects of leakage currents to ground upon the electrical performance of Faraday and Hall-type MHD generators when the leakage resistance is distributed along the channel. Constant gas parameters and constant channel cross section are assumed. The numerical calculation performed for a typical generator has shown that this effect is not too large when the insulation resistance between the electrode and the generator casing is of the order of several thousand ohms. Author (NSA)

N71-34885# Institute of Nuclear Research, Warsaw (Poland).
LEAKAGE CURRENTS IN THE FARADAY TYPE MHD GENERATOR WITH NONUNIFORM GAS
Z. Celinski 1971 19 p
(INR-1243) Avail: AEC Depository Libraries

One-dimensional gas flow in the presence of leakage currents is considered. Results of calculations point out that the current-voltage characteristics of the generator may be strongly nonlinear and a gas acceleration mode of operation may be established in the outlet part of the generator channel. The two-dimensional gas flow in the presence of leakage currents is considered. The possibility of the numerical analysis of such problems by means of the equivalent circuit method is shown. Some interesting effects occurring in such a case are discussed and quantitatively estimated in the numerical example. Author (NSA)

N71-34886# Scientific Translation Service, Ann Arbor, Mich.
SKIN EFFECT IN HIGH ENERGY Z-DISCHARGES
L. V. Dubovoi, V. P. Fedyakov, and V. P. Fedyakova 1970 17 p

refs In RUSSIAN; ENGLISH summary
(NP-18775) Avail: AEC Depository Libraries

Results of experiments with pulsed z-discharges, characterized by anomalous plasma conductivity in a skin-layer region are analyzed. It is shown that features of powerful direct discharges, particularly in a case of fast z pinches, are in agreement with the hypothesis of probable excitation of ion-acoustic microinstabilities in current layers of the discharges. Author (NSA)

N71-34887# Japan Atomic Energy Research Inst., Tokyo.
CALCULATION OF THE FLUX OF FAST NEUTRAL PARTICLES FROM A CYLINDRICAL, HIGH-TEMPERATURE PLASMA
Suykuro Yano Dec. 1970 40 p refs
(JAERI-Memo-4243) Avail: AEC Depository Libraries

Using particle conservation equations for fast hydrogen atoms, slow hydrogen molecules, and charged particles, the fast atomic hydrogen flux produced by charge exchange in a high-temperautre plasma was numerically calculated for the average plasma temperatures of 10, 100, and 1000 eV and the neutral gas pressures of 0.0001 to 10 to - 10th power torr, assuming the plasma energy does not depend on position. Density of slow hydrogen molecules was assumed to be determined by the pressure of the filling gas for discharge and also by the desorbed gas from the wall by fast-particle impact. The calculated value of atomic hydrogen flux varies over a wide range of 10,000 to 10 to 18th power atoms/sq cm/s, depending on the density and energy of the plasma and on the conditions of the wall. The particle loss rate due to charge exchange is considerably large for a low-density plasma with fairly high residual gas pressure, but decreases to quite low values when the plasma density is high. Author (NSA)

N71-34888# Japan Atomic Energy Research Inst., Tokyo.
REVIEW OF USSR TOKAMAK EXPERIMENTS
Kazuo Toi and Satoshi Itoh Jan. 1971 108 p refs
(JAERI-Memo-4286) Avail: AEC Depository Libraries

The results of USSR Tokamak experiments are reviewed and classified according to equilibrium, instabilities and oscillations, thermal insulation and transport phenomena. Several problems of Tokamak plasmas for future study are listed.
Author (NSA)

N71-34889# Nagoya Univ. (Japan). Inst. of Plasma Physics
ION HEATING CAUSED BY ION ACOUSTIC WAVES IN AN ION STREAMING PLASMA
Tadao Honzawa and Yoshinobu Kawai Jan. 1971 20 p refs
(IPPJ-104) Avail: AEC Depository Libraries

It is experimentally shown that ion heating occurs because of ion acoustic waves arising from the drift of electrons in an ion-streaming plasma. The drift of electrons is controlled by changing the bias applied to a meshed grid inserted in the plasma. The results indicate that, when the drift velocity of electrons is settled at a proper value, one can observe standing wave-like ion acoustic waves as well as the increase of ion temperature, and there is a good correlation between the increase of ion temperature and the amplitudes of the ion waves. Explanation of the mechanism of ion heating is also described.
Author (NSA)

N71-34890# Los Alamos Scientific Lab., N. Mex.
PASSIVE DIAGNOSTICS OF A PLASMA FOCUS USING CHARGED PRODUCTS OF THE dd-REACTION
I. F. Belieeva et al Oct. 1970 14 p refs Sponsored by AEC
(LA-tr-71-6; IAE-2016) Avail: NTIS

In an apparatus of the noncylindrical z-pinch type, a method of study using charged products of the d,d reaction was applied. A flux of charged particles carries additional information on the magnitude, direction, and distribution of the magnetic field in comparison with neutron radiation. Special pinhole cameras, provided with nuclear emulsions, were used for recording. The distributions of charged products of d,d reactions obtained in the emulsions are compared with the results of calculations. The maximum value of the magnetic field, Hphi, in the zone of the focus was determined. Author (NSA)

N71-34891# Transtek Associates, Reading, Mass.
ELECTRON-ION BEAM INSTABILITY
M. V. Nezlin et al Feb. 1971 25 p refs Transl. into ENGLISH from Russian report
(Contract AT(30-1)-1238)
(MATT-Trans-83; IAE-1516) Avail: NTIS

An experimental study was made of axially symmetrical electron-ion oscillations of a quasi-neutral electron beam in a longitudinal magnetic field. It was demonstrated that the dispersion properties of the oscillations, their spatial structure and excitation conditions correspond well to the theory of ordinary beam electron-ion instability. Excitation of the oscillations is accompanied by ion acceleration to significant energies comparable to the beam electron energies. In contrast to the electron-ion oscillations without axial symmetry and excited as a result of drift-beam instability, the investigated oscillations do not lead to restriction (cutoff) of the beam current. Author (NSA)

N71-34892# Transtek Associates, Reading, Mass.
A STUDY OF THE EFFECT OF THE SHAPE AND MAGNITUDE OF THE DISCHARGE CURRENT PULSE ON PLASMA CONFINEMENT AND HEATING IN THE TOKAMAK-3
S. V. Mirnov Princeton, N.J. Princeton Univ. Feb. 1971 42 p refs Transl. into ENGLISH of Gos. Kom. po Ispolz. At. Energii, Inst. At. Energii, Moscow, report IAE-1644
(Contract AT(30-1)1238)
(MATT-Trans-79; IAE-1644) Avail: NTIS

The results of measuring the energy and energy lifetime of a plasma as functions of the shape and magnitude of the discharge current pulse are given. As is known, the maximum magnitudes of the energy and energy lifetime of plasma were reached 2 to 3 milliseconds after the maximum discharge current in the T-3 device. Energy and energy lifetime are presented as functions of the shape of the discharge current pulse and the discharge time. An effort was made to relate the observed relations to the current-density distribution. Assumptions were made regarding the nature of the processes determining the observed laws. One of the possible assumptions is the assumption of the presence of either a dissipative helical (tearing mode) or overheating instability in the initial discharge stage and while the current is building up. Author (NSA)

N71-34893# Los Alamos Scientific Lab., N. Mex.
INVESTIGATION OF THE STABILITY OF A TOROIDAL PLASMA RING WITH A HIGH-FREQUENCY CURRENT ALONG THE LONGITUDINAL MAGNETIC FIELD
M. A. Vasilevskii (Efremov Res. Inst., Leningrad, USSR) et al Mar. 1971 3 p refs Transl. into ENGLISH from Proc. of the Intern. Symp. on closed confinement systems, Dubna, USSR, Sep. - 3 Oct. 1969 Sponsored by AEC
(LA-4339-TR; Conf-690931-5) Avail: NTIS

Results of stability study of a toroidal plasma ring with a high-frequency current in a longitudinal quasi-stationary magnetic field in a chamber with a conducting wall are presented. The results were obtained on Toloskop. The magnetic field was varied from 0.2 to 6 kOe, and the amplitude of the high-frequency (1.1 Mc) current from 1.5 to 7.5 Ka.
Author (NSA)

N71-34894# Princeton Univ., N.J.
DRIFT-BEAM INSTABILITY AND ION SOUND IN AN INHOMOGENEOUS PLASMA
M. V. Nezlin et al 1968 36 p refs Transl. into ENGLISH from Russian report
(Contract AT(30-1)-1238)
(MATT-Trans-84; IAE-1515) Avail: NTIS

Electron-ion (ion-sound) oscillations without axial symmetry were detected in an electron beam passing through a rarefied gas. It was shown that their spatial structure, dispersion properties, and excitation conditions correspond to the drift beam (ion-sound) instability of an inhomogeneous plasma.
Author (NSA)

N71-34895# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
GENERALIZED ONE DIMENSIONAL MAGNETOHYDRODYNAMIC COMPUTER CODE FOR PARTIALLY IONIZED HYDROGEN OR HELIUM PLASMAS
F. Hofmann Feb. 1971 42 p refs
(LRP-46/71) Avail: NTIS

A computer program was developed to solve the generalized MHD equations (including electron inertia and drift velocity effects) for four fluids in one dimension. The physical model and numerical methods are discussed. Results of a typical calculation are presented.
Author

N71-34896# Princeton Univ., N.J. Plasma Physics Lab.
ANOMALOUS ABSORPTION OF ELECTROMAGNETIC WAVES BY PLASMA
V. V. Pustovalov and V. P. Silin 1970 27 p refs Transl. into ENGLISH from Zh. Eksp. Teor. Fiz. (Moscow), v. 59, 1970 p 2215
(Contract AT(30-1)-1238)
(MATT-Trans-105) Avail: NTIS

The spectral energy density of ion-sound oscillations in a non-isothermal plasma located in the field of an electromagnetic wave is found. The high-frequency conductivity of a weakly turbulent plasma with developed ion-sound noise is calculated for an electromagnetic wave frequency close to the plasma frequency. It is shown that the electromagnetic wave absorption coefficient associated with such conductivity is large compared with ordinary absorption determined by collisions between electrons and ions.
Author (NSA)

N71-34897# Scientific Translation Service, Ann Arbor, Mich.
HIGH FREQUENCY HEATING OF PLASMA AT FREQUENCIES NEAR THE LOWER HYBRID FREQUENCY
S. V. Galaktinov et al 1970 8 p refs Transl. into ENGLISH from A. F. Ioffe Inst. of Ind. Phys., Akad. Nauk SSSR (Leningrad), 1970 Submitted for publication Sponsored by AEC prepared in cooperation with Oak Ridge Natl. Lab., Tenn.
(ORNL-tr-2435; FTI-282) Avail: NTIS

Some experiments on the hf heating of a hydrogen plasma are described. The boundary of efficient heating was found at the magnetic fields corresponding to the low hybrid frequency. The energy input decreased considerably below the critical field. The plasma density was determined when the efficiency of the coupling circuit was at a maximum. From an analysis of the diamagnetic pressure distribution along the discharge tube, it became possible to separate the diamagnetic effects due to ions and electrons. The energy of ions and electrons was nearly the same.
Author (NSA)

N71-34898# Scientific Translation Service, Ann Arbor, Mich.
COLLECTIVE DECELERATION OF A BEAM OF ENERGETIC RELATIVISTIC ELECTRONS IN A DENSE PLASMA TARGET
L. I. Rudakov 1970 27 p refs Transl. into ENGLISH from Russian report IAE-2004 Sponsored by AEC Prepared in cooperation with Oak Ridge Natl. Lab., Tenn.
(ORNL-tr-2432; IAE-2004) Avail: NTIS

It is demonstrated that slowing down of an initially monoenergetic beam in accordance with the one-dimensional model is valid only for moderate-strength beams. Slowing down of more intense beams or beams with an initial angular velocity dispersion theta may occur only as the result of the induced Cherenkov effect (kinetic instability). However, even for kinetic instability, the quasi one-dimensional character of beam retardation remains. As a consequence, the characteristic instability increment is a function of the initial theta. The role of nonlinear scattering of Langmuir oscillations by plasma particles, which leads to saturation of the unstable oscillation amplitude, and also the effect of inhomogeneity of the plasma target are analyzed. A formula for the mean free path of a relativistic electron beam in a dense plasma target is presented. It is shown that beam instability may increase the effective scattering frequency of the plasma electrons. This may result in an increase of the rate of heating of the target due to ohmic dissipation of the inverse current and the beam slowing down involved.
Author (NSA)

N71-34899# Los Alamos Scientific Lab., N. Mex.
LASER INDUCED PLASMA INSTABILITY
J. P. Freidberg and B. M. Marder Jan. 1971 7 p refs
(Contract W-7405-eng-36)
(LA-4604) Avail: NTIS

A simple picture is presented of the instability induced by an electric field oscillating near the plasma frequency.
Author (NSA)

N71-34900# Los Alamos Scientific Lab., N. Mex.
THE FORMULATION OF A HELICALLY SYMMETRIC MAGNETOHYDRODYNAMIC THETA PINCH PROBLEM
Harold Weitzner Jan. 1971 10 p refs
(Contract W-7405-eng-36)
(LA-4599) Avail: NTIS

In preparation for numerical computation of dissipative magnetohydrodynamic systems with helical symmetry, a model is formulated and equations are given. After some manipulations, Maxwell's equations without displacement current are rewritten in terms of the basic helical fluxes and the two basic input functions of time, the current in the outer conductor, and the electromotive force across the gap. One possible set of fluid equations is also given.
Author (NSA)

N71-34901# Cornell Univ., Ithaca, N.Y. Plasma Studies Lab.
A PROPOSAL TO STUDY TURBULENT HEATING OF A PLASMA Annual Progress Report, 1 Apr. 1970 - 31 Mar. 1971
1971 27 p refs
(Contract AT(30-1)-3958)
(NYO-3958-4) Avail: NTIS

The results of research on scaling laws and on optimizing the experiment as a plasma heating device are reported. Outstanding among these are the measurements of ion energy distribution and isotropy, and the determination that the final ion temperature depends on the initial plasma conductivity. High-energy X-rays were observed during the turbulent phase of heating.
NSA

N71-34902# Transtek Associates, Reading, Mass.
ON THE POSSIBILITY OF SIMULTANEOUS TRANSFORMATION AND CHANNELING OF ENERGY IN AN INHOMOGENEOUS MEDIUM
N. S. Erokhin and S. S. Moiseev Dec. 1970 8 p refs Transl. into ENGLISH from Ukrainian report KHFTI-70-20
(Contract AT(30-1)-1238)
(MATT-Trans-103; KHFTI-70-20) Avail: NTIS

Wave propagation in an inhomogeneous medium in the form of narrow channels was studied. The intersection of solutions in the vicinity of the pole of the corresponding differential equation is derived. Complete absorption of the wave in the vicinity of the pole is demonstrated. When considering thermal motion in an inhomogeneous plasma, this corresponds to 100% mutual transformation of the plasma and electromagnetic modes.
Author (NSA)

N71-34903*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ELECTRON WAVE INSTABILITIES IN A MAGNETOPLAS-

MA CAUSED BY ELECTRON-NEUTRAL COLLISIONS
John Q. Howell Washington Sep. 1971 113 p refs
(NASA-TR-R-363; L-7531) Avail: NTIS CSCL 20I

A new class of collision-dependent electron waves is found in a non-Maxwellian Lorentz Magnetoplasma, and it is shown that electron-neutral collisions may cause these waves to become unstable. The Boltzmann equation with collision integral is solved while assuming propagation to be either parallel or perpendicular to the magnetic field. Both conductivity tensors are derived and put in a form that is usefull for numerical calculations. The full set of Maxwell's equations is then used to derive the dispersion relations for both directions of propagation. The dispersion relations are initially solved for a monoenergetic electron distribution function and then an isotropic distribution with a peak of nonzero half-width is treated. Some consideration is also given to an isotropic Maxwellian distribution both with and without a bump on the tail. As an example of propagation parallel to the magnetic field, transverse electromagnetic or whistler waves in a nitrogen plasma are considered. A new collisional mode is found with real frequency near the electron cyclotron frequency, and under appropriate conditions it may be either convectively or absolutely unstable. Longitudinal or electrostatic waves propagating perpendicular to the magnetic field in a nitrogen plasma are also considered. A series of new collisional modes with real frequency near the electron frequency and its harmonics are shown to be unstable under some conditions. For both directions of propagation, the electron waves can be unstable if a large fraction of plasma electrons have their velocity in a region where the electron-neutral collision frequency increases (or decreases) rapidly enough. The requirement on the electron-neutral collision frequency is easily met by nitrogen, mercury, and the Ramsauer gases. Author

N71-34904# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
INVESTIGATION ON PREIONIZATION FOR TOROIDAL HIGH BETA EXPERIMENTS
A. Eberhagen Dec. 1970 26 p refs
(IPP-1/114) Avail: AEC Depository Libraries

Pre-ionization is achieved in toroidal geometry by induced azimuthal currents. Favorable breakdown properties down to filling pressures of 3 mtorr D sub 2 and suitable pre-ionization plasmas were established by application of an RF predischarge and superposition of small magnetic fields with only 10 kV potential difference around the 200-cm-long torus circumference. Detailed studies were performed on the effectiveness of the RF oscillations, e.g., as to their frequency and amplitude, and on the achievement of a stable and clean pre-ionization plasma with only negligible amounts of plasma currents present.
Author (NSA)

N71-34905# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sukumi (USSR). Fiziko-Tekhnicheskii Inst.
STUDIES OF DIFFUSION OF DENSE DISINTEGRATING PLASMA IN A STELLARATOR
R. A. Demirkhanov, D. G. Beratov, N. I. Malykh, V. G. Merezhkin, M. A. Stotland et al 1970 13 p refs In RUSSIAN
(NP-18767) Avail: AEC Depository Libraries

Disintegration of helium plasma in a two-pass stellarator with magnetic field varying from 6 to 12 kOe was studied under conditions in which the classical diffusion was smaller than the Bohm diffusion and the free electron mean-free-path was considerably shorter than the length of the system. The density and plasma temperature were approximately 1 x 10 to the 14th power/cu cm and 0.6 eV, respectively. Data obtained showed that in the case of recombination, the plasma confinement time (as a function of the magnetic field intensity and the rotational transformation angle) was in good agreement with the hydrodynamic model of classical plasma diffusion in a toroidal helical magnetic field. Author (NSA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-34906*# California Univ., Santa Barbara. Solid-State Lab.
RELIABILITY STUDIES IN SEMICONDUCTOR FABRICATION Final Technical Report
[1971] 17 p refs
(Grant NGR-05-010-041)
(NASA-CR-119800) Avail: NTIS CSCL 20L

An anodic oxidation was used on silicon wafers to measure junction depth as a function of the BBr3 system parameters. In this process silicon oxide is grown on the surface of a silicon wafer through which impurities have been diffused. After a short cycle of oxide growth, the oxide is etched from the wafer surface by use of a standard HF etch. The V/I measurements made on the exposed surface indicate the total impurities in the wafer in the region from the surface to the position of the junction. Successive oxidations, etchings, and V/I measurements gradually lead to an accurate determination of the position of the junction. The series of V/I measurements made between steps of anodic oxidation serve also to measure or delineate the profile of impurities from the original wafer surface to the position of the junction. A computer program (OLS) was established to allow accurate and convenient measurements of anodic-oxide thickness and V/I. E.M.C.

N71-34907*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF THE MECHANISMS OF FLUX PINNING IN TYPE 2 SUPERCONDUCTORS Final Report
H. T. Coffey, F. Chilton, and T. W. Barbee, Jr. Feb. 1971 80 p refs
(Contract NAS8-24816; SRI Proj. 8043)
(NASA-CR-121867) Avail: NTIS CSCL 20L

Theoretical and experimental studies were made of the flux pinning mechanisms in type-2 superconductors. A theoretical model based on the London theory was used to obtain trail functions for a variational calculation using the Ginzburg-Landau theory. The microscopic properties of fluxoids were calculated. The model was applied to the problem of flux pinning by (1) large defects having a gradient, (2) small normal regions or voids, and (3) small regions having values different from the bulk of the sample, which seems to be responsible for the peak effect in type-2 superconductors. The forces arising from these pinning mechanisms were related to the critical transport current and were found to provide reasonable approximations to experimental data. Specific heat measurements were made on annealed and deformed pure niobium samples. Tight adhesion of the ferromagnetic power to the sample prevented stripping the power for observation in an electron microscope. E.M.C.

N71-34908# Academy of Sciences (USSR), Moscow. Inst. Atomnoi Energii.
KRISTALL PROGRAM FOR STUDYING DYNAMICS OF RADIATION DAMAGE IN CRYSTAL LATTICES [PROGRAMMA KRISTALL DLYA ISSLEDOVANIYA DINAMIKI RADIATSIONNYKH NARUSHENIY V KRISTALLICHESKOI RESHETKE]
Yu. N. Knizhnikov 1970 44 p refs In RUSSIAN
(IAE-2002) Avail: AEC Depository Libraries

A study of the basic principles of writing an all-purpose computer program to simulate processes in crystal lattices of various types (face-centered cubic, body-centered cubic, and diamond), considering the thermal vibrations of the atoms is presented. Results of computer experiments are presented as examples of use of the program, including experiments for the silicon lattice. The establishment of thermodynamic equilibrium in a crystal lattice and the process of transition to the molten state are also simulated. NSA

N71-34909# International Atomic Energy Agency, Vienna (Austria).
CROSS SECTIONS FOR RADIATIVE NEUTRON CAPTURE BY U 238 NUCLEI
L. P. Abagyan et al Mar. 1971 29 p refs Transl. into ENGLISH from Russian report
(INDC(CCP)-11/U) Avail: AEC Depository Libraries

With a view to establishing reasonable energy resolution and measurement accuracy requirements in respect to cross sections for the radiative capture of neutrons by uranium-238, an analysis was made of the requests contained in RENDA and elsewhere for these cross sections in the energy range 1 eV-15 MeV. The published results of experimental work are considered and their reliability and possible reasons for discrepancies analyzed, particular attention being paid to the choice of reference cross sections and to the calculation of the self-shielding effect. It is noted that the spread of sigma gamma (U-238) values remaining after all renormalizations far exceeds the accuracy required by the users. Methods of calculating cross sections for capture in uranium-238 are discussed and results are presented. On the basis of selected experiments and calculations an evaluation is made of cross sections for neutron capture by uranium-238, the results being presented in the form of a smooth curve. Author (NSA)

N71-34910# Centre National de la Recherche Scientifique, Paris (France).
APPLICATION OF SUPERCONDUCTORS IN MICROWAVE TECHNIQUES: OSCILLATORS, PARTICLE ACCELERATORS [APPLICATIONS DES SUPRACONDUCTEURS EN HYPERFREQUENCES: OSCILLATEURS, ACCELERATEURS DE PARTICULES]
A. Septier 1970 13 p refs In FRENCH Presented at Panel on Superconductors, Paris, 17-18 Mar. 1970
(CONF-700341-4) Avail: AEC Depository Libraries

A brief description of the characteristics of the impedance of the surface of metals and superconductors at low temperature is given. The performances of superconductors in the microwave cavity techniques used with particle accelerators or in the development of oscillators are examined. The results obtained with a loop oscillator, a monotron oscillator, and a tunnel diode oscillator are described. Possible applications of the Josephson effect in the generation of UHF waves are considered. NSA

N71-34911# United Kingdom Atomic Energy Authority, Harwell (England).
SINGLE-CRYSTAL TARGETS OF RUBIDIUM URANYL NITRATE FOR THE ALIGNED FISSILE NUCLEI EXPERIMENT
J. C. Waldron Sep. 1969 13 p
(AERE-R-6141) Avail: AEC Depository Libraries

The growing of single crystals of rubidium uranyl nitrate and the cutting from them of selected faces that were coated with a thin layer of fissile isotope analog are reported. The crystallographic character of the substance is described. Author (NSA)

N71-34912# Arizona Univ., Tucson. Dept. of Physics.
X-RAY SLIT SYSTEM FOR CRYSTALS WITH SMALL ANGLE BOUNDARIES
C. Eubig and C. T. Tomizuka [1971] 7 p refs
(Contract AT(11-1)-1041)
(COO-1041-18) Avail: NTIS

A slit subassembly is described in which each of the slit sides can be adjusted independently to within 0.014 mm. By placing two such subassemblies at 90 deg to each other, a slit with adjustable height, width, and position is obtained. Two such slits mounted some distance apart make up the collimating system for the X-ray beam. High purity single crystals of aluminum were required with precise orientation, shape, and dimensions. The adjustable slit system was used to obtain rocking curves for high precision measurement of changes in the position of a Bragg reflection. Author

N71-34913# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
SOLID STATE PHYSICS; MAGNETIC PHENOMENA
Progress Report, 1 Jan. - 31 Dec. 1970
R. Bowers and R. H. Silsbee 31 Dec. 1970 15 p refs
(Contract AT(30-1)-2150)
(NYO-2150-66) Avail: NTIS

Microwave resonance studies in alkali halides were continued, including molecular orientation freedom in alkali halides. Other studies concentrated on ultrasound generated by eddy currents in potassium, electron-electron scattering in tungsten, and zero-field efficiency of ultrasound generated by eddy currents. E.M.C.

N71-34914*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THEORY OF THE TWO SUBLATTICE HEISENBERG ANTIFERROMAGNET
Edwin G. Wintuckey and Larry Flax Washington Sep. 1971 9 p refs
(NASA-TN-D-6499; E-6429) Avail: NTIS CSCL 20L

Thermodynamic properties of the two sublattice anisotropic Heisenberg antiferromagnet are calculated by the Green function method in the random phase and Callen approximations for spin 1/2. Analytic expressions for the sublattice magnetization and internal energy are obtained which are valid over the whole temperature range up to the Neel temperature for the body centered cubic lattice. Author

N71-34915*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MAGNETIZATION AND SUSCEPTIBILITY OF THE HEISENBERG FERROMAGNET
Lawrence Flax Washington Sep. 1971 18 p refs
(NASA-TN-D-6420; E-6216) Avail: NTIS CSCL 20L

The anisotropic Heisenberg ferromagnet developed by Flax and Reich is reevaluated to include an applied magnetic field. The present calculation is restricted to the case of an isotropic exchange interaction, and the random phase approximation is used. The present theory predicts a broadening of the transition region with increasing magnetic field. Thermodynamic quantities, such as magnetization and susceptibility, are studied near the Curie point. Author

N71-34916# Toulouse Univ. (France).
STUDY OF IMPURITY BAND CONDUCTIVITY IN SILICON BY COMPENSATION METHOD [ETUDE DE LA CONDUCTION PAR BANDE D'IMPURETES DANS LE SILICIUM AU MOYEN DE LA COMPENSATION]
Jean Francois Roux (Ph.D. Thesis) 27 Jun. 1969 91 p refs In FRENCH
(N-816) Avail: NTIS

The diffusion mechanisms responsible for charge carrier mobility in doped silicon are studied in an effort to determine compensation methods for impurity band effects on electrical conductivity. Phonon diffusion, impurity ions, and neutral impurities are considered. A two-conduction band model is formed for calculating the density of constant impurities, as well as the reduced density of free charge carriers in the conduction band caused by effects of the impurity bands. Measured conductivity and Hall effects in phosphorus-doped and partial aluminum-compensated silicon samples are analyzed as functions of: (1) concentration of impurity additives and absorption; (2) reduction of ionization energy; and (3) pseudo-mobility of the impurity bands. Results indicate the presence of pairing effects, and show that the reduction of ionizing energy is most effective in narrowing the width of the impurity band. Transl. by G.G.

N71-34917# Paris Univ., Orsay (France).
CONTRIBUTION TO THE STUDY OF INTERNAL FRICTION IN COLD DRAWN AND IRRADIATED ALUMINUM [CONTRIBUTION A L'ETUDE DU FROTTEMENT INTERNE

DANS L'ALUMINIUM ECROUI ET IRRADIE]
Sylvain Duval (Ph.D Thesis) 8 Jul. 1969 105 p refs In FRENCH
Avail: NTIS

The behavior of aluminum irradiated at low temperatures, and reheated to approximately ambient temperatures, was examined. Ultrasonic measurements on monocrystal aluminum samples after irradiation and cold working established the relationship between sample purity and its elastic modulus, observed bordoni peaks at 30 mhz for the same dislocation defect suggested two different dislocation processes corresponding to fundamental and activation energy frequencies. It is concluded that internal friction exists in the lattice after hardening due to the formation of point defect groups, and that reheating activates interstitials so that they attach themselves at the dislocations. Transl. by G.G.

N71-34918# Sandia Corp., Albuquerque, N. Mex. Engineering Applications Div.
NET TRANSISTOR AND DIODE LIBRARY TAPE 4925, REFERENCE NO. 1006, 13 DECEMBER 1968
Clint Purdue Apr. 1970 16 p Sponsored by AEC
(SC-M-710210) Avail: NTIS

The model parameters for ninety semiconductor devices are stored on tape number 4925. The user need only call out the anode-cathode or emitter base and collector nodes followed by the diode or transistor type number. The model parameters are then transferred to the main circuit program, NET, for processing in the automatically formulated equations. Any or all of the parameters listed for a specific device can be changed using the parameter modification feature of the NET program. This capability enables the user to model a device which is not included on the library tape. The model topology and equations are given. Author

N71-34919# Oak Ridge National Lab., Tenn.
SOLID STATE DIVISION Annual Progress Report, period ending 31 Dec. 1970
Mar. 1971 117 p refs
(Contract W-7405-eng-26)
(ORNL-4669) Avail: NTIS

Research is reported in the following areas: optical properties, electronic structure, and band theory; magnetic resonance; magnetic properties; lattice dynamics; low-temperature properties; radiation damage; surface studies, diffraction, and channeling; research materials; and experimental equipment and new techniques. NSA

N71-34920# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
DISLOCATION STRESSES IN A THIN FILM DUE TO THE PERIODIC DISTRIBUTIONS OF DISLOCATIONS
K. Seito, R. O. Bozkurt, and T. Mura [1970] 23 p refs Sponsored by AEC
(COO-2034-6) Avail: NTIS

The state of stresses and displacements in thin films due to the presence of a periodic distribution of screw dislocations and edge dislocations is investigated by the method of continuously distributed dislocations and the three dimensional theory of elasticity. The dislocations are straight and pierce obliquely the surfaces of the thin films in both cases. As a special case the exact solution is presented for a straight edge dislocation piercing normally the surfaces of the films. Emphasis is placed upon the stress relaxation caused by the presence of free surfaces. The result is useful for the contrast study of dislocation images in electron microscopy. Author

N71-34921# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
LOW-TEMPERATURE LATTICE THERMAL CONDUCTIVITY OF HIGH-PURITY TUNGSTEN
D. K. Wagner Mar. 1971 15 p refs Supported in part by ARPA
(Contract AT(30-1)-2150)
(NYO-2150-69; Rept-1527) Avail: NTIS

Measurements of the lattice thermal conductivity of high-purity tungsten were made at low temperatures (1.5 to 6 K) by suppressing the electronic thermal conductivity with a magnetic field. The results show that the lattice thermal conductivity is proportional to T squared as expected for a pure metal in which the phonons are scattered mainly by the conduction electrons. The measured value of the lattice thermal conductivity is (0.5 + or - 0.05) T squared mW/cm-K. Author (NSA)

N71-34922# Technische Hochschule Munchen (West Germany).
STUDIES ON THE HYPERFINE STRUCTURES OF GAMMA RESONANCE ABSORPTION SPECTRA AT HIGH PRESSURE [UNTERSUCHUNGEN DER HYPERFEIN-STRUKTUR VON GAMMA-RESONANZ-ABSORPTIONSSPEKTREN UNTER HOHEN DRUCK]
Hans-Georg Boehm (Ph.D. Thesis) 10 Dec. 1970 67 p refs In GERMAN
Avail: NTIS

High pressure gamma resonance absorption spectra were obtained at 4.2 K on two ytterbium compounds and for a magnetically ordered tin compound. The pressure effects on hyperfine structures were determined from isomeric shifts, inner magnetic fields, quadrupole splittings, and changes between f-factors and volumes. Results showed that during ytterbium transfer to the bcc-high pressure phase a partial depletion of the 4f-level in favor of the 5d-6s conductivity band is possible; a complete change from the two to three valence does not take place. Measurements on the intermetallic compound MnSn2 indicated structural changes with core polarization of magnetic fields on the Sn kernels in correlation with temperature effects; the quadrupole splitting was also effected by the surrounding spin structure. Transl. by G.G.

N71-34923# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaften.
THE INFLUENCE OF LATTICE DEFECTS ON PROTON AND HELIUM ION BACKSCATTERING FROM SINGLE NIOBIUM CRYSTALS [DER EINFLUSS VON GITTERFEHLERN AUF DIE RUECKSTREUUNG VON PROTONEN UND HELIUMIONEN AN NIOB-EINKRISTALLEN]
Helge Schulze (Ph.D. Thesis) 25 Jan. 1971 41 p refs In GERMAN
Avail: NTIS

The effects of temperature and radiation dosage on 100 keV proton and helium ion backscattering from niobium monocrystals were measured. Lattice defect concentrations were determined for the surface and the first hundred atomic levels according to backscatter intensities. Observed intensities were almost temperature independent from -80 to 900 C with GF/N sub v approximately 0.0001 for the niobium monocrystal. Irradiation at a (111) direction with a bombardment dosage of 2 x 10 to the 16th power protons per sq cm, or by 3 x 10 to the 17th power positive He ions per sq cm at 20 C produced in a 20 A thick niobium surface layer so many lattice defects that the structure was termed to be amorphous. The subsurface layer of about 100 A thickness exhibited relatively less radiation damage with the lattice defect concentration at approximately 0.0001. Bombardment at 900 C did not increase lattice defects, and it was assumed that radiation damage was annealed. Transl. by G.G.

N71-34924# Technische Hogeschool, Eindhoven (Netherlands).
AN INVESTIGATION INTO THE STRUCTURE OF THE PARTICLES IN FINELY GROUND QUARTZ CRYSTALS [EEN ONDERZOEK NAAR DE STRUCTUUR VAN DE DEELTJES VAN FIJNGEMALEN KWARTS]
Kasper Koopmans (Ph.D. Thesis) 16 Mar. 1971 149 p refs In DUTCH; ENGLISH summary

Avail: NTIS

The diffraction patterns of quartz powders with a mean particle size of about 0.00015 and 0.0002 cm show line broadening only in the high-angle region. This broadening is caused by deformed outer layers built up around the particles during the grinding process. From the X-ray diffraction and electron diffraction diagrams it is concluded that these particles hardly contain any amorphous SiO2. In the outer layer stresses occur. The deformed structure recovers to a great extent but not completely by a heat treatment at 1200 C during 7 1/2 hour. A lower limit to the thickness of the deformed outer layer appears to be about 0.00003 cm. Powders having mean particle sizes of 0.0014 and 0.0028 cm show the effects of particle absorption and extinction, giving rise to smaller integrated intensities of the Debye-Scherrer lines. It is most probable that secondary extinction occurs, and that the perfect crystal domains are in good alignment and have mean dimensions of about 0.00008 and 0.00012 cm respectively. Author

N71-34926# Technische Hochschule Munchen (West Germany).
Pt-195 NUCLEAR MAGNETIC RESONANCE STUDIES IN TETRAGONAL CRYSTALLINE PLATINUM COMPLEXES [195PT-KMR-UNTERSUCHUNGEN AN KRISTALLINEN QUADRATISCHEN PLATINKOMPLEXEN]
Herbert Rupp (Ph.D. Thesis) 1971 71 p refs In GERMAN
Avail: NTIS

Anisotropy and order of magnitude of chemical Pt-195 shifts in crystalline platinum complexes at various oxidation levels were measured by nuclear magnetic resonance spectra. It was shown that increased strengths of the equatorial ligands in sixfold coordinated tetragonal complexes decreased the anisotropy in Pt-195 shifts. Resonance from crystalline potassium dioxalato platinates(II) established two magnetically equivalent complex units per element cell; correlation between shifts and crystal orientation established a 44 deg. angle between complex levels parallel to the crystallographic a-axis. Pt-195 resonances were not obtained with polycrystalline probes of partially oxidated platinum (II,IV)-complexes. Transl. by G.G.

N71-34928*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PHOTOCONDUCTIVE AND OPTICAL PROPERTIES OF AMORPHOUS SELENIUM
John A. Woollam, Kenneth R. Marash, Mitchell Kuninsky, and Benjamin L. Averbach Washington Sep. 1971 27 p refs
(NASA-TN-D-6500; E-6302) Avail: NTIS CSCL 20L

The electron and hole drift mobilities in photoconducting amorphous selenium were measured. Samples were prepared by vapor deposition on substrates held both above and below the selenium glass transition temperature T sub g. This shows that the substrate deposition temperature has little effect on the mobility at 300 K, however, from the temperature dependence of the hole mobility, a thermal activation energy of 0.200.02 eV was observed for samples deposited below T sub g. This is higher than previously reported for samples deposited near T sub g. Mobility is found to be independent of magnetic fields to 1 tesla within an accuracy of 5 percent. Mobility at 300 K is also shown to be independent of wavelength from 0.22 to 0.60 micrometer; however, the number of carriers is very dependent on wavelength, and this determines the wavelength cutoff in the number of carriers excited to mobile states. The photoconductivity edge was found near 0.5 micrometer and the optical absorption edge between 0.66 and 0.90 micrometer. A phenomenon was investigated for temperatures below 200 K, where voltage-against-time curves are exponential, rather than linear, and the exponential decay is strongly temperature dependent. Another result was that the electron mobility changed by a factor of 3 for electric fields greater than 5 x 1 million V/m. Author

N71-34927# Puerto Rico Nuclear Center, Mayaguez.
LEAST-SQUARE REFINEMENT OF THE X-RAY DATA ON AZURITE, Cu3(OH)2(CO3)2
Robert Kleinberg [1970] 10 p refs
(Contract AT(40-1)-1833)
(PRNC-145) Avail: NTIS

An isotropic least squares refinement of reported X-ray data on azurite gives a set of positional parameters which is statistically equivalent to the set originally determined from two-dimensional Patterson and Fourier work. The largest difference between any two corresponding positional parameters is equivalent to a distance of 0.062 A. Author

N71-34928 National Lending Library for Science and Technology, Boston Spa (England).
ON SUPERCONDUCTIVITY OF THE CRYSTALS OF THE SEMICONDUCTORS FOUND IN THE LIGHT FIELD OF LASER
V. D. Plazhin et al [1971] 17 p refs Transl. into ENGLISH from Fiz. Tverd. Tela (NSSR), v. 12, no. 11, 1970 p 3229-3233
(NLL-M-20655-(5928.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The mechanism of a powerful light strengthening the polarization of electrons in the valence region is examined in the Brillouin zone of semiconductor crystals. Using Hamiltonian functions, and omitting Coulomb interaction between P-electrons and the holes, it is shown that excitons are not formed. It is concluded that the induction of electronic polarizability in the semiconductors by lasers substantially intensifies the attractions of electrons in the copper pairs. F.O.S.

N71-34929 Princeton Univ., N.J.
AVALANCHE MULTIPLICATION IN BULK n-Si
Vikram L. Dalal. (Ph.D. thesis) 1969 212 p
Avail: Univ. Microfilms Order No. 70-14200

It is shown that the avalanche coefficients of electrons can be determined from the slope of the current versus time curves. The experimentally determined avalanche coefficient alpha(E) is compared with the theory of Barrett. It is found that it is possible to fit the theory with ionization energy epsilon sub i, such that epsilon sub g less than epsilon sub i less than 1.5 epsilon sub g, and phonon mean free path lambda such that 60 less than lambda less than 80 A. The values of alpha(E) measured in this study are in good agreement with the extrapolated values of Lee et al., on p-n junctions, but disagree with the results of Ogawa on p-i-n junctions. Author

N71-34930 Tufts Univ., Medford, Mass.
STUDIES IN OSMIUM CHEMISTRY. PART 1: THE METALLIC NATURE OF OSMIUM DIOXIDE. PART 2: THE REACTION OF OSMIUM TETROXIDE WITH HYPOPHOSPHOROUS ACID
Donald Bruce Willson (Ph.D. Thesis) 1969 82 p
Avail: Univ. Microfilms Order No. 70-18018

The growth of single crystals of osmium dioxide and electrical transport measurements on the crystals are reported. Osmium dioxide shows conductivities characteristic of metallic conductors. The results are explained by considering a wholly collective electron approach involving the concepts of narrow bands and high density of states. The crystalline product of the reaction of osmium tetroxide with hypophosphorous acid in 4 N hydrochloric acid followed by the addition of tetra-n-butylammonium chloride is described. Analyses, electronic spectra, infrared spectra, NMR spectra, magnetic measurements, molecular weight measurements, and conductivity measurements are presented, the sum of which identify the green complex. Dissert. Abstr.

N71-34931 Minnesota Univ., Minneapolis.
LUMINESCENCE PHENOMENA IN MAGNESIUM OXIDE
Chieh-Chung Chao (Ph.D. Thesis) 1969 155 p
Avail: Univ. Microfilms Order No. 70-15711

Parallel studies of luminescence and electron-spin resonance spectra of trivalent Cr ions in single crystals of MgO are reported. A red thermoluminescence induced in nominally pure

MgO single crystals by X-ray or ultraviolet irradiation and peaking near 375 K was identified by comparison with the trivalent Cr fluorescence spectrum as being primarily the R-line and N-line emission of excited trivalent Cr ions, together with their vibrational side bands. The major mechanism for the production of trivalent Cr X-ray fluorescence in MgO is believed to be the combination of a positive hole with divalent Cr to produce excited trivalent Cr ions, which return to the ground state with R-line or N-line emission, depending upon the environment. It was found that the intensity of trivalent Cr X-ray fluorescence in nominally pure MgO was not proportional to the concentration of trivalent Cr. Treatment in Mg vapor which reduces all trivalent Cr to divalent Cr did not cause a significant change in fluorescence intensity. Dissert Abstr.

N71-34932 Washington Univ., Seattle.
CREEP OF ALUMINUM OXIDE SINGLE CRYSTALS AND BICRYSTALS
Raymond Lee Bertolotti (Ph.D. Thesis) 1970 93 p
Avail: Univ. Microfilms Order No. 70-19613

Compressive creep of aluminum oxide single crystals and bicrystals was investigated in the temperature range of 1400 to 1700 C. Dislocation glide, deformation twinning, and grain boundary sliding were observed. The activation energy for basal slip in aluminum oxide was found to be a function of the applied stress. Overcoming a large Peierls-Nabarro stress offers the best explanation for the rate controlling mechanism. Rhombohedral twinning was found to be a significant deformation mode in creep and was dependent on surface damage for nucleation. The activation energy for rhombohedral twin growth was a function of the applied stress and was substantially lower than for basal slip. Cracking can result from twin/twin and twin/grain boundary intersections. Grain boundaries can present a substantial barrier to twinning. Grain boundary sliding in aluminum oxide bicrystals was rapid under conditions of zone shear. Dissert. Abstr.

N71-34933 Princeton Univ., N.J.
SUPERMOLECULAR STRUCTURE OF POLY-GAMMA-BENZYL-L-GLUTAMATE: LIQUID CRYSTAL PHASE AND SOLID STATE
Edward Thaddeus Samulski (Ph.D. Thesis) 1970 110 p
Avail: Univ. Microfilms Order No. 70-19801

The properties of solid poly-gamma-benzyl L-glutamate (PBLG) films are correlated with the arrangement of rodlike helical molecules. This supramolecular structure in the solid state is derived from the liquid crystal phase. Low angle X-ray diffraction in plasticized PBLG films exhibits the same polypeptide concentration dependence as the liquid crystalline solutions. Solid films possess the optical characteristics indicative of the helicoidal supramolecular structure in the liquid crystal. The liquid crystal phase can be used as a nematic solvent for NMR experiments. Interactions between the polypeptide and the solute molecule are correlated with the orientation of the latter. The NMR spectra of small solute molecules swollen into the solid PBLG films can be correlated with the helical arrangement. Oriented polypeptide films can be prepared by evaporating solutions in a strong magnetic field. Small differences in polypeptide conformations due to solvent effects may be measured using this technique. Dissert. Abstr.

N71-34934 California Univ., Los Angeles.
THEORY OF ORIENTIONAL MOTION IN CRYSTALLINE N2
Jane Rudolph Kessler 1970 268 p
Avail: Univ. Microfilms Order No. 70-19862

The role played by orientational degrees of freedom of nitrogen molecules in phase transition phenomena is evaluated. A statistical mechanical calculation was made of the free energy associated with molecular orientational motion in three lattice models of crystalline nitrogen. The self-consistent method employs free energy minimization to obtain a family of functional integral equations which must be satisfied by the molecular orientational distribution functions. Calculations are carried out for interaction of a given molecule with only the nearest neighbor shell, and interaction with additional shells. Only the first three shells are of significance. Of the three phases of uniform order considered, two exhibit rigid localization of molecular orientation, with only torsional oscillation possible, and the third possesses free rotation in a plane. The transition between the two-fold localized phase and the planar free rotor phase represents the alpha-beta transition of crystalline at atmospheric pressure and the gamma-beta transition at elevated pressures. Both transitions are associated with changes in the character of orientational motion. Dissert. Abstr.

N71-34935 South Carolina Univ., Columbia.
STRUCTURAL STUDIES OF METAL-SULFUR BONDS
William Augustine Spoffard, III (Ph.D. Thesis) 1970 88 p
Avail: Univ. Microfilms Order No. 70-19605

The crystal structures of four complexes of sulfur containing ligands with metallic ions have been determined by three dimensional single-crystal X-ray diffraction techniques. They are: (1) bis(thiourea)copper(I)chloride; (2) tetrakis(thiourea)cobalt(II) nitrate monohydrate; (3) tetrakis(thioacetamide)nickel-(II)bromide and (4) cis-dichlorobis(4,4'-dichlorodi-phenylsulfide)platinum(II). Dissert. Abstr.

N71-34936 Rensselaer Polytechnic Inst., Troy, N.Y.
PREPARATION AND PROPERTIES OF TRANSITION: METAL OXIDE FILMS OF NICKEL AND IRON
Walter John Frey (Ph.D. Thesis) 1970 490 p
Avail: Univ. Microfilms Order No. 70-19937

The oxides NiO and alpha-Fe2o3, while insulating when pure or stoichiometric, can be transformed into p- and n-type seimconductors by impurity additions or by deviations in chemical stoichiometry. Crystalline and amorphous thin films of NiO and alpha-Fe2O3 were prepared by the technique of radio frequency sputtering of their oxide targets. The films' structure, chemistry, and electrical behavior were examined as a function of the oxygen content of the sputtering atmosphere and the deposition temperature. The structure and properties of the Ni(x)O(Y) films were more sensitive to varying sputtering parameters than the alpha-Fe(x)O(Y) films. The deposition temperature's effect on the Ni(x)o(Y) film structure and chemistry was best explained by the increase in available oxygen at the substrate surface with decreasing deposition temperature. In view of the decrease in thermoelectric power with increasing temperature in nearly stoichiometric crystalline Ni(x)O(Y) films, the conventional band model best described electrical conduction in these films. Dissert. Abstr.

N71-34937 Rensselaer Polytechnic Inst., Troy, N.Y.
INVESTIGATION OF THERMODYNAMIC AND SOLID STATE PROPERTIES OF THE SYSTEM MANGANESE SELENIDE-CADMIUM SELENIDE
Andrew Gary Sigai (Ph.D. Thesis) 1970 168 p
Avail: Univ. Microfilms Order No. 70-19953

High purity single crystals of MnSe, CdSe, and CdSe-rich solid solutions were grown from the vapor either by chemical transport reactions with iodine as the transport agent or by direct sublimation. The effect of the transport mode (convection or diffusion) on the crystal morphology was demonstrated for CdSe. Convection controlled transports favor platelet growth; diffusion favors needle growth. Experimental work revealed that the increase of chemical etching times and/or etching concentration used to clean the transport tube change the growth habit of MnSe from platelets to octahedra. The use of the binary compounds or the elements as starting materials leads to inhomogeneous alloy crystals increasingly richer in CdSe. The variation of the optical energy gap with composition of the solid solution was determined by diffuse reflectance measurements on powders and transmittance measurements on vapor grown single crystal platelets. Dissert. Abstr.

N71-34938 North Texas State Univ., Denton.
ELECTROCHEMICAL DISSOLUTION OF ZnO SINGLE CRYSTALS

David Dixon Justice (Ph.D. Thesis) 1970 116 p
Avail: Univ. Microfilms Order No. 70-17979

The elemental semiconductors, germanium and silicon, can be thought of as forming one type of bridging route between metallic and insulator bonds. The existence of oxidation-reduction steps (electrochemical dissolution) has been demonstrated for germanium and silicon. Compound semiconductors, such as ZnO, can be thought of as forming a second type of bridging route between metallic and insulator bonds; however, the existence of oxidation-reduction steps has not even been suggested for a wide band gap semiconductor such as ZnO. In order to determine if oxidation-reduction steps are present during the dissolution of ZnO single crystals, the purpose of this investigation was to determine whether or not these dissolution rates were a function of potential and, if a potential dependency were found, to measure the dissolution rates as a function of potential and correlate them with existing theories of electrochemical dissolution. Dissert. Abstr.

N71-34939 Iowa State Univ. of Science and Technology, Ames.
CRYSTAL NUCLEATION AND GROWTH KINETICS IN BATCH EVAPORATIVE CRYSTALLIZATION
Janardhana Santwal Baliga (Ph.D. Thesis) 1970 131 p
Avail: Univ. Microfilms Order No. 70-18878

A general population balance equation was derived and solved for batch crystallization. An evaporative crystallizer subject to the constraints of constant growth rate and homogeneous nucleation was considered and developed. Several crystallization runs were made using the potassium sulfate system. The crystal growth rate was size dependent, and the population distributions for different crystallization times appeared to have grown from an initial crystal size distribution. To completely describe the size distributions in batch crystallization, either the initial distribution should be identified or the precise kinetic growth and nucleation relationships must be known. Dissert. Abstr.

N71-34940 Iowa State Univ. of Science and Technology, Ames.
INTRINSIC CLASSIFIED WITHDRAWAL IN CONTINUOUS WELL MIXED CRYSTALLIZATION
George William Becker, Jr. (Ph.D. Thesis) 1970 190 p
Avail: Univ. Microfilms Order No. 70-18879

The applicability of the uniform withdrawal assumption, used in the development of the continuous crystallizer design equations, to laboratory scale continuous mixing vessels was investigated. A discussion of the pertinent laws of physics and the existing theory of anisokinetic sampling of aerosols is presented. Phenomenological equations relating the concentrations of the various sized particles within a typical suspension were developed by assuming that the withdrawal operation could be characterized as a discrete state time homogeneous Markov process for which the particle concentrations are independently distributed. An experimental draft tube mixing vessel was used to test the Markov model and to determine the behavior of particle residence times at various operating conditions. Empirical size dependent particle residence time functions were determined from the experimental data and are used to discuss the effect of classified withdrawal on continuous crystallization.
Dissert Abstr

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-34941*# Georgia Inst. of Tech., Atlanta.
THE PREDICTION OF THE NONLINEAR BEHAVIOR OF UNSTABLE LIQUID ROCKETS
Eugene A. Powell and Ben T. Zinn Jul. 1971 84 p refs
(Grant NGL-11-002-083)
(NASA-CR-72902) Avail: NTIS CSCL 21H

An analytical technique is developed to solve nonlinear combustion instability problems associated with liquid propellant rocket motors. The analysis produces the limit cycle behavior of unstable motor operation and the threshold amplitude required to trigger a linearly stable motor into unstable operation by considering second order terms in the conservation equations. Calculated results indicate the limit cycle amplitude increases with (1) increasing sensitivity of the combustion process to a pressure oscillation, (2) increasing chamber Mach number, and (3) decreasing chamber length-to-diameter ratio. Calculated pressure waveforms exhibit sharp peaks and shallow minima. The frequency is always within a few percent of the pure acoustic mode frequency. Author

N71-35036*# TRW Systems Group, Redondo Beach, Calif.
ZERO-g PROPELLANT GAUGING OF CRYOGENICS
R. G. Morrison *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 37-52 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

N71-35037*# Bendix Corp., Davenport, Iowa.
ZERO-g RADIO FREQUENCY GAGING SYSTEM FOR SPACE SHUTTLE PROPELLANT TANKS
H. E. Thompson (NASA, Marshall Space Flight Center), N. E. Stanley, B. J. Shebler, and W. Ott *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 53-72 Supported by NASA Marshall Space Flight Center 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-34942*# Republic Aviation Div., Fairchild Hiller Corp., Farmingdale, N.Y.
QUASI-STEADY AND SHORT PULSE DISCHARGE THRUSTER EXPERIMENTS
William J. Guman Jun. 1971 80 p refs
(Contract NAS1-9925)
(NASA-CR-111935; PCD-TR-71-3; FHR-3795-1) Avail: NTIS CSCL 21C

The solid Teflon propellant pulsed plasma thruster was scaled to operate in the millipound thrust regime. The performance of the thruster was determined and compared when operated either as a short pulse discharge thruster or as a quasi-steady thruster. Erosion was also quantitatively evaluated. The performance of propellant breech fed short pulse discharge thruster configurations was scaled predictably into the millipound regime from earlier microthruster results. Exploratory tests with propellant side-feed configurations showed significant performance improvements could be realized over breech fed configurations. A power to thrust ratio of 156 watts/millipound was measured at a specific impulse of 1245 sec. Erosion was found to depend upon electrode material and the duration of the test. In particular, erosion expressed as the ratio of mass eroded to propellant mass used was found to vary directly with specific impulse. The somewhat limited number of results show thrust efficiency of short pulse discharge operation to be better than quasi-steady operation when compared at the same specific impulse. Erosion measured during short pulse discharge

operation was found to be much lower than that measured for quasi-steady discharge operation compared at the same specific impulse. Author

N71-34943*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PRELIMINARY INVESTIGATIONS OF ION THRUSTER CATHODES
Raymond Goldstein, Eugene V. Pawlik, and Liang-Chi Wen 1 Aug. 1971 19 p refs
(Contract NAS7-100)
(NASA-CR-121631; JPL-TR-32-1536) Avail: NTIS CSCL 21C

Results of experimental and analytical studies of mercury vapor-fed hollow cathodes for ion thrusters are presented. These studies have included the thermal and electrical characteristics of the cathodes. It is shown that the primary electron emission mechanism is thermionic when sufficient low work function material is present in the cathode. The cathode temperature is determined by the current demanded by the external circuit and the work function of the emitting surface. The result is an increase in cathode temperature as the low work function material is depleted. In addition, attempts to reduce cathode temperature by changes in external thermal coupling result only in increasing the power extracted from the discharge. These phenomena affect overall thruster performance. Author

N71-34944*# General Motors Corp., Indianapolis, Ind. Detroit Diesel Allison Div.
EXPERIMENTAL EVALUATION OF LOW CYCLE THERMAL FATIGUE IN A TURBINE VANE FABRICATED FROM LAMINATED POROUS MATERIAL Final Report
D. A. Nealy, R. D. Anderson, and A. A. Hufford 15 Mar. 1971 116 p refs
(Contract NAS3-12431)
(NASA-CR-72954; DDAD-EDR-7034) Avail: NTIS CSCL 21E

The results of an experimental evaluation of low cycle thermal fatigue in laminated porous wall turbine vanes are presented. Details of the laminated porous wall vane design are given together with a description of the cascade test facility and associated instrumentation. Three test vanes were exposed to rapid cyclic gas temperature variations over a range from 1150 F to 2800 F. After 110 cycles of operation, transverse (chordwise) cracks were observed in the leading edge region of all three test vanes. Subsequent metallographic and structural analyses indicated the primary failure mechanism to be low cycle thermal fatigue. Agreement between predicted and observed fatigue life was very good. Author

N71-34946*# Curtiss-Wright Corp., Wood-Ridge, N.J.
TIP-TURBINE LIFT PACKAGE DESIGN
R. Jaklitsch, A. Leto, W. Pratt, and R. Schaefer Jul. 1971 222 p
(Contracts NAS3-14327; NAS3-12423)
(NASA-CR-72974; CW-WR-71-034.F) Avail: NTIS CSCL 21E

A layout design of a lift fan driven by a two-stage hot turbine at the fan blade tips is reported. Layout drawings, a description of the lift package system, and a discussion of the design analyses are presented. Areas of major design analyses included segmented and continuous turbine blade support rings, a hot-gas scroll, hot-gas seals during transient thermal and maneuver load conditions, main support bearings, and system weight. Author

N71-34948*# Aerojet Liquid Rocket Co., Sacramento, Calif.
APOLLO SERVICE PROPULSION SYSTEM ROCKET ENGINE BIPROPELLANT VALVE IMPROVEMENT PROGRAM Summary Report, Jul. 1969 - Feb. 1971
Mar. 1971 12 p
(Contract NAS9-8317)
(NASA-CR-108578) Avail: NTIS CSCL 21H

Research was directed toward the improvement of the Apollo service propulsion system rocket engine bipropellant valve, and oxygen-hydrogen technology. Two workhorse type valves were fabricated and tested with two types of seals at cryogenic temperatures. E.M.C.

N71-34947*# Aerojet Liquid Rocket Co., Sacramento, Calif.
EXTENDABLE NOZZLES FOR SPACE ENGINES. 2: DESIGN GUIDE Final Report
Nov. 1970 120 p
(Contract NAS9-10484)
(NASA-CR-115119; Rept-10484-FR-Vol-2) Avail: NTIS CSCL 21H

Optimized techniques of nozzle translation, alignment, sealing, and cooling as well as nozzle performance and thermal design data are presented for use in the design of a deployable nozzle. The use limits of the data presented, as established by the specified operating conditions, include: a chamber pressure of 300 to 800 psia; a thrust of 5000 to 20,000 lb; and a nozzle expansion ratio of 50:1 to 300:1. For vol. 1, see N71-31606. D.L.G.

N71-34948*# TRW Systems Group, Redondo Beach, Calif.
DESIGN AND DEVELOPMENT OF A GAS MANAGEMENT SUBSYSTEM FOR A BRAYTON SPACE POWER SYSTEM
A. F. Haack Feb. 1970 126 p
(Contract NAS3-10937)
(NASA-CR-72631; TRW-09708-6001-R0-00) Avail: NTIS CSCL 21G

A gas management subsystem for use with the Brayton space power system was designed and developed, and components for two subsystems delivered. The design was based on a five-year operational life, high reliability, an xenon-helium working fluid, and stringent leakage requirements. The program included preparation of an enthalpy-entropy diagram for the gas mixture, system design compatible with the gas mixture, and component development. Subsystem requirements, modes of operation, component description, supporting analyses, and component development problems are discussed. Author

N71-34949*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLID PROPELLANT ROCKET MOTOR Patent Application
Warren L. Dowler, inventor (to NASA), John I. Shafer, inventor (to NASA), John W. Behm, inventor (to NASA), and Leon D. Strand, inventor (to NASA) Filed 28 May 1971 18 p
(Contract NAS7-100)
(NASA-Case-NPO-11559; US-Patent-Appl-SN-147996) Avail: NTIS CSCL 21H

A solid propellant rocket motor having a controlled rate of thrust buildup to a desired thrust level by the combined utilization of a regressive-burning controlled flow solid propellant igniter and a progressive-burning main solid propellant charge is considered. The igniter is capable of operating in a vacuum and sustaining the burning of the propellant below its normal combustion limit until the burning propellant surface and motor chamber pressure has increased sufficiently to provide a stable motor chamber pressure. NASA

N71-34950*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio. Design Criteria Office.
LIQUID ROCKET ENGINE TURBOPUMP INDUCERS
Jakob K. Jakobsen (Rocketdyne, Canoga Park, Calif.) and Russell B. Keller, Jr., ed. May 1971 107 p refs
(NASA-SP-8052) Avail: NTIS CSCL 21H

A critical evaluation is presented of available information on the hydrodynamics, mechanical design, development, and testing of pump inducers. Additional data is provided concerning material selection and vibration and stress problems. The evaluation is aimed at seeking an optimization of the hydrodynamic parameters to obtain the highest suction specific speed possible without violating structural and mechanical design constraints. The approach used is to design for the

maximum acceptable tip cavitation number by a mathematical optimization process. D. L. G.

N71-34951*# National Aeronautics and Space Administration, Washington, D.C.
PLASMA ACCELERATION IN A TRAVELLING ELECTROMAGNETIC FIELD: GENERAL DIAGNOSTIC AND VELOCITY MEASUREMENTS [ACCELERATION D'UN PLASMA PAR UN CHAMP ELECTROMAGNETIQUE GLISSANT. DIAGNOSTICS GENERAUX ET MESURES DE VITESSE]
M. Charpenel et al Sep. 1971 42 p refs Transl. into ENGLISH from French report ONERA-TN-174
(NASA-TT-F-697) Avail: NTIS CSCL 21C

For studying the processes of ionization and acceleration by travelling electromagnetic fields, and exploring the basic characteristics (temperature, density, velocity) of the plasma involved, an experimental device of pulsed operation was created, which ensures simple diagnostic means for the measurement of electric and magnetic fields, induced current density, temperature, and velocity. Another technique applied serves to determine the two last named parameters indirectly. The results, when described and analyzed, point to the presence, near the exit plane of the device, of a temperature wave propagating at the velocity of the relative electric field. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-34952*# New Hampshire Univ., Durham. Dept. of Physics.
MEASUREMENTS OF THE NEUTRON INTENSITY IN SPACE Final Report
J. A. Lockwood Jun. 1971 21 p refs
(Grant NSR-30-002-049)
(NASA-CR-121629) Avail: NTIS CSCL 03B

Balloon and rocket flight activities have emphasized: (1) measurements of the fast neutron flux and energy spectrum near the top of and above the atmosphere; (2) measurements of the gamma ray flux and energy spectrum in the energy interval 0.5-10 Mev simultaneously on the same flights; (3) extension of the energy range of the neutron and gamma ray detectors; and (4) completion of a rocket flight to measure the fluxes of neutrons, gamma rays, X-rays (0.1-2.0 A range) and low energy charged particles above the atmosphere. Author

N71-34953*# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
EXPERIMENT ON S57 (LATER OSO 3) SATELLITE (COSMIC RAY CHARGE AND ENERGY SPECTRA) Final Report
Morton F. Kaplon Jun. 1971 66 p refs
(Contract NAS5-3178)
(NASA-CR-121626) Avail: NTIS CSCL 03B

The results of the S-57 (later OSO-3) investigation of the high energy charged component in a distortion free atmosphere are reported. Details of the detector design and operation were given and results were reported in tabular form. Some of the objectives for which results were reported included: the charge composition of the quiescent cosmic radiation; the integral energy spectrum of all components; the charge composition of solar flare emitted beams within the various components; the cosmic ray albedo, both of the splash and re-entrant type; modulation of the intensities of protons and He nuclei as a function of time; and the detection of high energy gamma rays of celestial origin. J.G.M.

N71-34954*# Sanders Associates, Inc., Burlington, Mass. Big Bear Solar Observatory.
MAGNETIC FIELDS, BREMSSTRAHLUNG AND SYNCHROTRON EMISSION IN THE FLARE OF 24 OCTOBER 1969
H. Zirin, Gail Pruss, and Joan Vorpahl [1971] 19 p refs Prepared in cooperation with Carnegie Inst. of Washington, Stanford, Calif. and Calif. Univ., Berkeley
(Contract NAS5-9094; Grants NGL-05-002-034; NSL-05-002-071; NSF GA-24015)
(NASA-CR-121620) Avail: NTIS CSCL 03B

The investigation of an impulsive flare on October 24, 1969 which produced two bursts with virtually identical time profiles of 9800 MHz emission and X-rays above 48 KeV is reported. The two spikes of hard X-rays correspond in time to the times of sharp brightening and expansion in the H-alpha flare. The first burst was not observed at frequencies below 3000 MHz. This cut off is ascribed to plasma cut off above the low-lying flare. A model of the flare based on H-alpha observations shows that the density of electrons with energy above 10 KeV is 5 x 10 to the 7th power if the field density is 10 to the 11th power. The observed radio flux would be produced by this electron distribution with the observed field of 200 gauss. The H-alpha emission accompanying the hard electron acceleration is presumed due to excitation of the field atoms by the hard electrons. Author

N71-34955*# California Inst. of Tech., Pasadena.
A NOTE ON CHROMOSPHERIC FINE STRUCTURE AT ACTIVE REGION POLARITY BOUNDARIES
Stephen W. Prata [1971] 9 p refs
(Grants NGL-05-002-034; NSF GA-24015)
(NASA-CR-121619) Avail: NTIS CSCL 03B

High resolution H-alpha photographs, showing dark structure along zero longitudinal field lines in active regions, are investigated. Results indicate (1) active region filaments are on boundaries between weak field regions, while cross boundary structures occur between stronger fields, (2) arches appear roughly radiating from sunspots, (3) field transition arches are found only where opposite polarity regions of strong field are closely adjacent, and (4) a single boundary may contain field transition arches and regular filaments. Examinations also show the forms themselves are transmutable. E.H.W.

N71-34956*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
NOTE ON THE CHARACTERISTICS OF SUNSPOT GROUPS WHICH PRODUCE SOLAR PROTON FLARES
Kunitomo Sakurai Jul. 1971 12 p refs
(NASA-TM-X-65637; X-693-71-287) Avail: NTIS CSCL 03B

The association of solar proton flares with sunspot groups which show an unusual distribution of magnetic polarities is discussed. It is noted that the gradient of the magnetic field is very large before the onset of these flares and that the importance of polar cap absorptions, which is proportional to the integral flux of solar cosmic rays, tends to increase as the gradient of the magnetic field becomes greater. It is shown that the formation of such gradients is associated with the rotating motion of sunspot groups and that the sunspot groups which show a reversed polarity distribution are very effective for the production of solar proton flares. Author

N71-34957*# Stanford Univ., Calif.
SOLAR-WIND FLOW PAST THE PLANETS EARTH, MARS, AND VENUS
Arthur William Rizzi (Ph.D. Thesis) May 1971 211 p refs
(Grant NGR-05-020-330; Contract NAS2-5535)
(NASA-CR-121671) Avail: NTIS CSCL 03B

Extensive theoretical studies, specific calculations, and detailed comparisons with observations have shown that the interaction of the solar wind and the earth may be represented satisfactorily, insofar as gross features of the flow such as density, velocity, temperature, and magnetic field are concerned.

by the standard continuum equations of magnetohydrodynamics. The same line of analysis is extended to objects in the solar system which have no significant intrinsic magnetic field, but a sufficiently dense and electrically conducting ionosphere to stop and deflect the solar wind before it is absorbed by the planetary surface or atmosphere. Author

N71-34958*# Louisiana State Univ., Shreveport. Dept. of Physics.
STUDY OF THE MODULATORY EFFECTS OF THE SOLAR WIND ON GALACTIC COSMIC RAYS
T. A. Moss [1971] 20 p refs
(Contract NAS9-9317)
(NASA-CR-115095) Avail: NTIS CSCL 03B

Incorporating a Monte Carlo analysis of a radial magnetic field model for the solar wind, it is found that for the quiet sun, a radius for the solar wind cavity of approx 5 a.u. is compatible with measured proton spectra. The scattering mean-free-path for galactic protons by magnetic irregularities in the cavity is L AU is approx 0.1 sq r AU P to the 1.5 power GeV. The unmodulated galactic proton energy spectrum is given by psi (E sub K) is approx (E sub K) to the minus 1.5 power for 0.1 < (E sub K) < 1.5GeV. The net work done upon galactic protons by the solar wind is negligible. The net work done on galactic protons by energetic stellar winds can be considerable. Author

N71-34959*# Scientific Translation Service, Santa Barbara, Calif.
EFFECT OF SECONDARY EMISSION OF THE POTENTIAL OF A METALLIC BODY IN THE ELECTRON RADIATION BELTS OF THE EARTH [VLIYANIYE VTORICHNOY EMISSII NA POTENTSIAL METALLICHESKOGO TELA V ELECTRONNYKH RADIATSIONNYKH POYASAKH ZEMLI]
T. Ya. Ryabova et al Washington NASA Sep. 1971 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Fiz (USSR), v. 35, no. 5, 1971 p 1075-1079
(Contract NASw-2035)
(NASA-TT-F-13903) Avail: NTIS CSCL 03B

The problem of creating a high negative potential on a screened spacecraft in order to protect the equipment and crew from intense electron streams in natural and artificial radiation belts of the earth is investigated. Author

N71-34960# Brookhaven National Lab., Upton, N.Y.
ON THE POSSIBILITY OF DETERMINING THE OSCILLATION PARAMETERS OF NEUTRINOS
G. E. Kocharov, B. A. Ferberg et al Apr. 1971 14 p refs Transl. into ENGLISH from Russian report. Sponsored by AEC
(BNL-tr-418) Avail: NTIS

A possible verification of the oscillation hypothesis of Pontecorvo is considered in the experiments on the measurement of the energy spectrum and solar neutrino flux.
Author (NSA)

N71-34961# Scientific Group for Space Research, Athens (Greece).
DATA OF SOLAR-TERRESTRIAL INTEREST
D. J. Ilias, ed. and D. P. Elias, ed. Mar. 1971 18 p
Avail: NTIS

A compilation of solar activity observations and ionospheric investigations by ground stations in Greece is presented. Subjects discussed are: (1) short wave fadeouts, (2) ionospheric absorption measurements, (3) satellite observations and (4) sunspot observations. P.N.F.

N71-34962*# Battelle Memorial Inst., Columbus, Ohio.
RADIATION EFFECTS DESIGN HANDBOOK, SECTION 5: THE RADIATIONS IN SPACE AND THEIR INTERACTIONS WITH MATTER
M. L. Green and D. J. Hamman Sep. 1971 65 p refs
(Contract NASw-1568)
(NASA-CR-1871) Avail: NTIS CSCL 03B

A summary of the types and sources of radiation encountered in space and how they interact with matter is presented. The detection and measurement of these radiations are discussed. Author

N71-34963# Los Alamos Scientific Lab., N. Mex.
VELA 5 AND VELA 6 SOLAR X-RAY ATLAS. 4: 11 APRIL - 1 SEPTEMBER 1970
N. K. Blocker, P. E. Fehlau, W. E. Kunz, W. H. Chambers, J. C. Fuller et al Jan. 1971 144 p refs
(Contract W-7405-eng-36)
(LA-4454-Vol-4) Avail: NTIS

Data obtained from the solar radiation monitors on the Vela 5 satellites are presented. Equivalent graybody flux in three bands (0.3 to 3, 1 to 8, and 1 to 16 Angstroms) is plotted as a function of universal time, one day per page. Data from April 11 to September 1, 1971, are presented. Author (NSA)

N71-34964# Los Alamos Scientific Lab., N. Mex.
VELA 5 AND 6 SOLAR X-RAY ATLAS. 3: 1 JANUARY 15 MAY 1970
N. K. Blocker, P. E. Fehlau, W. E. Kunz, W. H. Chambers, J. C. Fuller et al Jan. 1971 136 p refs
(Contract W-7405-eng-36)
(LA-4454-Vol-3) Avail: NTIS

Data obtained from the solar radiation monitors on the Vela 5 satellites are presented. Equivalent graybody flux in three bands (0.3 to 3, 1 to 8, and 1 to 16 Angstroms) is plotted as a function of universal time, one day per page. Data from January 1 to May 15, 1970, are presented. Author (NSA)

N71-34965# Los Alamos Scientific Lab., N. Mex.
A COMPILATION OF VELA 3 SOLAR WIND OBSERVATIONS, 1965 - 1967
S. J. Bame, H. E. Felthauser, A. J. Hundhausen, I. B. Strong, J. R. Asbridge et al Oct. 1970 90 p refs
(Contract W-7405-eng-36)
(LA-4536-Vol-1) Avail: NTIS

Solar-wind observations performed on the Vela 3 satellites between July 1965 and mid-1967 are summarized for use in comparison with solar and geomagnetic observations. Three-hour averages of the proton density, flow speed, flow direction, and proton temperature are presented graphically for each solar rotation. These averages and the standard deviations of observations within each three-hour interval are also given in tabular form. Author (NSA)

N71-34966# Technische Hochschule Munchen (West Germany).
DESCRIPTION AND SOME RESULTS FROM AN EXPERIMENTAL STUDY ON PRIMARY COSMIC RADIATION AND ITS EFFECT ON NUCLEAR EXCHANGES ABOVE 10GeV/NUCLEON [BESCHREIBUNG UND EINIGE ERGEBNISSE EINES EXPERIMENTES ZUR UNTERSUCHING DER PRIMAEREN KOSMISCHEN STRAHLUNG UND DURCH SIE HERVORGERUFENE KERNWECHSELWIRKUNGEN OBERHALB 10 GEV/NUKLEON]
Udo Pollvogt (Ph.D. Thesis) [Feb. 1970] 26 p refs In GERMAN
Avail: NTIS

The energy calibration and probable efficiency of a scintillation counter for measuring cosmic protons and alpha particles during balloon flights are described. The instrument contains two spark chambers, one above and the other below the target receiver, and an ionization calorimeter for determining the energy of impinging particles. Synchrotron proton measurements on 10, 20.5, and 28 GeV/c protons are used to simulate energy cascades and their effects on possible scintillation counter target emulsions. Transl. by G.G.

N71-34967# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
COSMIC RAY NM-64 NEUTRON MONITOR DATA. 17: MONTHLY GRAPHS, SEPTEMBER - DECEMBER 1970
J. F. Steljes Feb. 1970 67 p
(AECL-3856) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $1.50

Uncorrected and barometer corrected results from the cosmic ray stations in Canada using equipment maintained by AECL are given in tabular form for the period from September to December 1970. Normalized graphs are given for the same period. Correction factors for the constant rates of drift of the barometers at each of the four stations are given. Values of barometric coefficients determined on a yearly basis by regression analysis are given for the first time. These may be used for precision work in place of the present constant coefficient of 9.67% per cm Hg. Author (NSA)

N71-34968 National Lending Library for Science and Technology, Boston Spa (England).
POSSIBLE WAYS OF CHANGING THE TEMPERATURE AND RADIATION REGIME IN NORTHERN TOWNS
V. N. Ademenko et al [1971] 13 p Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 264, 1970 p 44-55
(NLL-M-20601-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Factor affecting the temperature and radiation regime of built-up and open areas in northern U.S.S.R. are investigated. Possible methods for regulating the thermal regime by altering the radiation reflected from vertical and horizontal surfaces are evaluated. J.G.M.

N71-34969 National Lending Library for Science and Technology, Boston Spa (England).
THE INCREASE IN CLOUDINESS TOWARDS THE HORIZON DUE TO THE CHANGE IN SOLID ANGLE SUBTENDED AT THE OBSERVER, AND ITS EFFECT ON DAILY AMOUNTS OF DIRECT SOLAR RADIATION AND DURATION OF SUNSHINE
E. L. Podolskaja [1971] 9 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), 1969 p 278-283
(NLL-M-20594-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Daily direct solar radiation and duration of sunshine calculations are presented and discussed. The effects of the increase in cloudiness toward the horizon due to the change in solid angle subtended by a cloud to the observer are included in the calculations. J.M.

N71-34970 National Lending Library for Science and Technology, Boston Spa (England).
A CONTRIBUTION TO THE THEORY OF THE EFFECT OF SOLAR ACTIVITY ON DISTRIBUTION CURVES IN THE CASE OF NATURAL RELAXATION OSCILLATIONS
A. A. Dmitriev [1971] 7 p refs Transl. into ENGLISH from Tr. Nauch.-Issled. Inst. Aeroklim. (Moscow), no. 63, 1970 p 63-69
(NLL-M-20596-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Starting with the equation that describes relaxation oscillations, it is shown that in the case of a natural oscillation process, the probability of a state is greater near the upper and lower limits for fluctuations in circulation. To find the effect of solar activity on atmospheric circulation by distribution curves, the inverse problem, and histograms for different levels of solar activity were considered. Temperature distribution curves for January and July at different levels of solar activity were obtained. F.O.S.

N71-34971 National Lending Library for Science and Technology, Boston Spa (England).
ON THE REALITY OF THE TWO-YEAR CYCLE OF SOLAR ACTIVITY
B. A. Slepcov-Shevelich 2 Mar. 1971 9 p Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauchn.-Issled. Inst. (Leningrad), no. 289, 1969 p 152-158
(NLL-M-20368-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A numerical analysis of solar activity to examine the reality of the theory of two year cycle of solar activity is presented. The analysis is based on the indices of the areas of sunspots and the indices of their lifetime. An index of the sun's corpuscular radiation is also investigated. Author

N71-34972 National Lending Library for Science and Technology, Boston Spa (England).
A CONTRIBUTION TO THE STUDY OF THE 11-YEAR PRESSURE WAVE DUE TO SUN IN THE EARTH'S SOUTHERN HEMISPHERE
I. V. Maksimov et al [1971] 5 p refs Transl. into ENGLISH from Tr. Arkt. Antarkt. Nauchn.-Issled. Inst. (Leningrad), no. 77, 1970 p 63-67
(NLL-M-20631-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Observations at 50 to 70 points in the Southern Hemisphere for 1900 to 1911, 1913 to 1923, 1923 to 1933, and 1933 to 1943 were used to investigate the 11 year fluctuations in the annual means of the atmospheric pressure. The data for each set of 11 years were analyzed by the harmonic method. Presented in tabular form are the phases of the 11 year pressure wave, the amplitudes of the wave, and the distribution of the amplitudes in relation to the latitude of the observation point. Author

N71-34973 Rochester Univ., N.Y.
VARIABLE ELECTRICAL CONDUCTIVITY IN SUNSPOT STRUCTURE
Yud-ren Chen (Ph.D. Thesis) 1970 146 p
Avail: Univ. Microfilms Order No. 70-17866

Some of the effects of the variation in conductivity are analyzed. Cylindrical models for the diffusion of sunspot fields have been developed. The results show that the decay rate is governed by the photospheric conductivity, and not by the much lower umbral conductivity. If, however, there are persistent motions outside the spot which tend to carry away the flux which leaks out, then the decay times estimated by Schroter (1964), based on the spot diffusivity, become relevant. The decay times for higher modes are determined by the low umbral conductivity, and they are generally shorter than a typical spot lifetime. Thus the field disruption across a spot is sensitive to the value of the electrical conductivity. To represent the depth dependence of the conductivity, calculations have been done for spheroidal models. The problem of umbral convection and the transmission of Alfven waves, generated in the sunspot interior, through the umbral layer of low conductivity were considered. Dissert. Abstr.

N71-34974 New York Univ., N.Y.
TEMPORAL AND MERIDIONAL VARIATIONS IN ZONAL MEAN RADIATIVE HEATING MEASURED BY SATELLITES AND RELATED VARIATIONS IN ATMOSPHERIC ENERGETICS
Jay Steven Winston (Ph.D. Thesis) 1969 167 p
Avail: Univ. Microfilms Order No. 70-16116

Temporal and meridional variations of zonal means of albedo and absorbed solar radiation, derived from digitized satellite pictures were examined for the period, February 1967 to February 1968. The annual courses of some prominent features of the zonal mean albedo are outlined including the maxima associated with the intertropical convergence zones, the minima of the subtropical anticyclones and equatorial dry zone, and the poleward ascendents of albedo from the subtropics. Harmonic analysis of the albedo values over a full year at individual latitude circles over the Northern Hemisphere indicate not only the predominance of the annual cycle and some other very long period oscillations, but also the prominence of oscillations of

28-30 days in the tropics and subtropics. Variations of zonally averaged albedo, absorbed solar radiation, outgoing long-wave radiation, and net radiation derived from scanning radiometer measurements in the period May to July 1966 are also presented. Albedo and absorbed solar radiation for the period are similar to the values for the corresponding period in 1967.
Dissert Abstr.

N71-34975 Washington Univ., St. Louis, Mo.
TRANSPORT OF HIGH-ENERGY COSMIC RAYS IN THE INTERSTELLAR MEDIUM
Robert Elwood Turner (Ph.D. Thesis) 1970 458 p
Avail: Univ. Microfilms Order No. 70-18935

The propagation of heavy nuclei in the interstellar medium is considered. A set of linear differential equations representing the abundances of the elements is solved. The slab model of cosmic rays assumes that all particles traverse the same distance from the source to the point of observation. A steady state model is also used. Three sets of coupled linear equations are solved, each of which represents a particular region. The first represents cosmic rays in the galactic disk, the second set describes particles in the galactic halo, and the third includes the metagalactic region. The light-to-medium ratio decreases as a function of the disk storage time, reaching a minimum, and then increases to its asymptotic limit. The nuclear parameters used in the transport equations are determined. Calculations are made to determine certain spallation cross sections which indicate that nuclei possess a neutron-rich surface. The abundances of the nuclides as a function of the galactic parameters are found.
Dissert. Abstr.

N71-34976 Indiana Univ., Bloomington.
HEATING OF THE CHROMOSPHERIC NETWORK BY HYDROMAGNETIC WAVES
Robert William Milkey (Ph.D. Thesis) 1970 82 p
Avail: Univ. Microfilms Order No. 70-19096

The calcium emission network is correlated with regions of intensified magnetic field and the boundaries of the photospheric supergranules. The chromosperic magnetic field retains characteristics of the network structure in the photospheric field. The propagation and dissipation of hydromagnetic waves are studied demonstrate the effect of concentrated magnetic fields on the height distribution of energy deposition in the solar atmosphere, and to illustrate a mechanism for the origin of the calcium network. The study was carried out for a range of temperature and magnetic fields models using a geometrical optics technique for studying the transport of energy by fast mode magnetoscoustic shocks. In the absence of a magnetic field the heating per gram of the chromosphere by dissipation of acoustic shocks is approximately constant with height. The introduction of a concentrated magnetic field causes the heating per gram to increase with height in the region where the field is concentrated.
Dissert. Abstr.

N71-34977 Washington Univ., St. Louis, Mo.
EXTREMELY HEAVY COSMIC RAYS
William Charles Wells (Ph.D. Thesis) 1970 145 p
Avail: Univ. Microfilms Order No. 70-18936

To observe the extremely heavy cosmic rays, three large area detectors have been successfully flown on high altitude balloons. Layers of nuclear photographic emulsions and plastic track detectors were interleaved. The former were used to measure the charges of the extremely heavy cosmic rays, while the latter made possible both rapid location of events and ionization determination. Because the balloons were launched from Palestine, Texas, where the geomagnetic cut-off is about 5 Gv, only relativistic particles were observed at the balloon altitude. The charge measurements in the nuclear emulsions which were made by studying the optical density as a function of distance from the particle's path are discussed. Dissert. Abstr.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-34978*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
OXYGEN AND WATER FROM LUNAR-SURFACE MATERIAL
W. R. Downs Jun. 1971 23 p refs Presented at Am. Inst. of Chem. Engr. Natl. Symp., Houston, Tex., 1-6 Mar. 1971
(NASA-TM-X-58061) Avail: NTIS CSCL 03B

Analyses of lunar soils returned by the Apollo 11 crewmen are indicative that chemically bound oxygen is a major constituent. The extraction of oxygen from the lunar surface material and the production of water on the moon are processes that must be developed before men can use the moon as a habitable base. Five chemical processes are described in this report: the carbothermic, hydrogen reduction, fluorine exchange, carbonate/oxygen, and electrolytic reduction processes. Experimental results are evaluated and problems are identified.
Author

N71-34979*# Bellcomm, Inc., Washington, D.C.
INFORMAL NAMES FOR SURFACE FEATURES IN THE APOLLO 15 LANDING AREA
James W. Head 16 Jul. 1971 7 p
(Contract NASw-417)
(NASA-CR-121625; B71-07022) Avail: NTIS CSCL 03B

The series of informal names which was assigned to surface features in the vicinity of the Apollo 15 landing site is given. The names were chosen by the Apollo 15 crew members prior to June 26, 1971, to provide more easily recognizable named landmarks along traverse routes and in areas such as the Apennine Front and Hadley Rille where extensive verbal descriptions were made.
Author

N71-34980*# Bellcomm, Inc., Washington, D.C.
DERIVATION OF TOPOGRAPHIC FEATURE NAMES IN THE APOLLO 15 LANDING REGION
James W. Head 16 Jul. 1971 7 p refs
(Contract NASw-417)
(NASA-CR-121624; B71-07023) Avail: NTIS CSCL 03B

The location and derivation of the nomenclature for topographic features in the Apollo 15 landing region are given. The contributions which the various philosophers, explorers, and scientists made to science are briefly summarized.
J.M.

N71-34981*# Bellcomm, Inc., Washington, D.C.
DENSITY AND FLUX DISTRIBUTIONS OF NEUTRAL GASES IN THE LUNAR ATMOSPHERE
T. T. J. Yeh and G. K. Chang 24 Jun. 1971 41 p refs
(Contract NASw-417)
(NASA-CR-121633; TM-71-2015-4) Avail: NTIS CSCL 03B

The density and flux distributions in the lunar atmosphere due to gas temperature and density variations at the surface were calculated using the kinetic theory of gases. Computation of neon density distributions along a 100 km equatorial circular orbit shows that the density on the day side is about one order of magnitude higher than that on the night side in the case of a uniform surface gas density N sub 0, but is a factor of 2 smaller in the case of N sub 0 approximately – to T sub 0 to the minus 5/2 power, where T sub 0 is the gas temperature at the surface. For argon, the corresponding values for these two cases are approximately 250 and 10. The density distribution of hydrogen in the 100 km orbit derived from the surface flux distribution given by Vogel indicates substantial lateral transport as well as particle loss due to thermal escape.
Author

N71-34982*# McDonnell Aircraft Corp., St. Louis, Mo.
A METHOD FOR PREDICTING THE PANEL FLUTTER FATIGUE LIFE OF SATURN 5 PANELS
Hans Peter Kappus, C. E. Lemley, and N. H. Zimmerman 22 Feb. 1971 40 p refs
(Contract NAS8-21250)
(NASA-CR-119886; MDC-A0938) Avail: NTIS CSCL 20K

Procedure for estimating the fatigue life of fluttering panels by using both theoretical and experimental data is described. The procedure includes techniques for estimating panel flutter onset dynamic pressure and for estimating surface stresses of panels deep in flutter. Application of this procedure should yield conservative results because of the following assumptions made in its formulation: (1) panels are loaded to buckling; (2) no static pressure differential exists across panel; (3) boundary layer has negligible effect; and (4) local aerodynamic conditions are assumed equal to freestream. The procedure was applied to skin panels typical of those on the Saturn 5 launch vehicle using the Apollo lunar trajectory. Even though panels of several different geometries were found to penetrate into the flutter region, no fatigue failures were predicted. The predicted level of fatigue damage due to flutter was low enough for all the geometries examined to ensure at least five missions before a skin panel failure. Author

N71-34983*# California Univ., Berkeley. Dept. of Physics.
SOME SPECIFIC RARE GAS STUDIES IN APOLLO SAMPLES
E. C. Alexander, Jr., P. K. Davis, W. A. Kaiser, Lewis R. S., and J. H. Reynolds 1971 7 p refs Presented at the 2d Ann. Lunar Sci. Conf., Houston, Tex., Jan. 1971 Sponsored in part by AEC
(NASA-CR-121722; UCB-34P32-0-3) Avail: NTIS CSCL 03B

Stepwise heating analyses of argon, krypton, and xenon gases from slow neutron irradiated lunar rocks 10044 and 10057 and electron microprobe analysis of K, Ba, Ce, Sr, Y, Zr, and U concentrations in sample 12013 are reported. Depth studies of cosmogenic gases in a 6.5 cm vertical column cut from rock 12002 are summarized including Xe-131/Xe-126 ratios and isotopic compositions of the spallation gases. J.M.

N71-34984*# Stanford Univ., Calif. Radioscience Lab.
RESEARCH AT THE STANFORD CENTER FOR RADAR ASTRONOMY Semiannual Status Report, 1 Jan. - 30 Jun. 1971
Jul. 1971 41 p refs
(Grant NGL-05-020-014)
(NASA-CR-121644; SASR-17) Avail: NTIS CSCL 03A

The research in the physical phenomena of space and planetary environments is reported along with the applications of the techniques of radio science. Faculty and student contributions are presented. Investigations reported include: possible models for clouds of the Venusian atmosphere, interfacing differential analyzers with general purpose computers, cost-performance analysis of horizontal sounding balloons, measurement of interplanetary electron density, and inexpensive antennas with low side lobes. A list of publications is also included. F.O.S.

N71-34985*# Wolf Research and Development Corp., Riverdale, Md.
NONAME SYSTEM DESCRIPTION, VOLUME 1
R. G. Williamson, C. F. Martin, and M. L. Dutcher 15 Feb. 1971 273 p refs
(Contract NAS5-11736)
(NASA-CR-121662) Avail: NTIS CSCL 22A

Detailed description of the NONAME program, the analyses and graphics support programs, and data handling support programs are presented. The orbit determination system consists of a set of computer programs for determining and analyzing definitive satellite orbits and their associated geodetic and measurement parameters. The estimation problem, motion of the earth and related coordinate systems, luni-solar ephemerides, and the observer's coordinate and time reference systems and polar motion are discussed. The measurement modeling, data preprocessing, force model and variational equations, integration and interpolation, statistical estimation procedure, and input/output are also covered. N.E.N.

N71-34986*# Wyzsza Szkola Pedagogiczna, Gdansk (Poland).
PROPOSED GEO-ALTITUDE COORDINATES OF VERTICAL POSITIONS
John C. Bellamy Jun. 1971 24 p refs
(Grant NGR-51-001-001)
(NASA-CR-121664) Avail: NTIS CSCL 22A

Geoaltitude coordinates of geometric height, pressure, temperature, density, and potential energy levels in and of the earth's atmosphere are defined in terms of a generalized concept of an Ideal Geo-Atmosphere. This simplified standard reference atmosphere utilizes the newly formulated geospheric system of units for coordinating the space-time positions and sizes and amounts of things throughout the earth-centered region of the universe. It is intended primarily to provide for coordinating meteorological and aeronautical practices throughout the world. Author

N71-34987*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ORBIT PERTURBATION THEORY USING HARMONIC OSCILLATOR SYSTEMS
William Byron Blair (Ph.D. Thesis - Stanford Univ.) Mar. 1971 124 p refs
(Grant NGR-05-020-007)
(NASA-CR-121667; LMSC-D-053810) Avail: NTIS CSCL 22A

Unperturbed two-body, or Keplerian motion is transformed from the time domain into the domains of two unique three dimensional vector harmonic oscillator systems. One harmonic oscillator system is fully regularized and hence valid for all orbits including the rectilinear case up to and including periapsis passage. The other system is fully as general except that the solution becomes unbounded at periapsis passage of rectilinear orbits. The natural frequencies of the oscillator systems are related to certain Keplerian orbit scalar constants, while the independent variables are related to well-known orbit angular measurements, or anomalies. The solutions to both systems are universally applicable functionally to all types of orbits. Perturbed two-body motion is then presented in the framework of perturbed harmonic oscillators. Nonlinear and linearized Encke perturbation equations, in vector form, are developed for both perturbed orbit oscillator systems, and the linearized vector perturbation equations are demonstrated to be directly solvable by quadrature in the domains of the respective oscillator systems. Author

N71-34988*# Translation Consultants, Ltd., Arlington, Va.
THE ATMOSPHERE OF VENUS [ATMOSFERA VENERY]
V. I. Moroz Washington NASA Aug. 1971 77 p refs Transl. into ENGLISH from Russian report OB-7
(Contract NASw-2038)
(NASA-TT-F-13722) Avail: NTIS CSCL 03B

Research on Venus has noticeably advanced in recent years. The results of direct measurement with the help of space instruments which probed the atmosphere of Venus in 1967 and 1969, namely, Venera-4, Venera-5, and Venera-6, have made the largest contribution. Interesting data were obtained as the result of the flight of the American spacecraft Mariner-5. Ground-based investigations have also contributed much that is new. The nature of this planet can only be understood on the basis of an analysis of all the results obtained by various methods. This review is such an analysis and includes the literature published up to the middle of 1969 and part of that published in the second half of 1969. Author

N71-34989*# American Science and Engineering, Inc., Cambridge, Mass.
FINAL DATA REDUCTION AND ANALYSIS OF THE AS

AND E OSO-4 GRAZING INCIDENCE X-RAY TELESCOPE EXPERIMENT Interim Report, 22 Jun. 1970 - 31 Mar. 1971
A. Krieger, W. Tucker, G. Vaiana, and D. Webb 1 Jun. 1971 178 p refs
(Contract NASw-2070)
(NASA-CR-121876; ASE-2736) Avail: NTIS CSCL 03B

An interim report is presented for the final data analysis of the grazing incidence X-ray telescope experiment on the pointed section of the OSO-4 satellite. The period of performance covered is from 22 June 1970 to 1 June 1971. The OSO-4 X-ray experiment produced raster scans of the sun in the 2.5 to 12 A waveband with a minimum time resolution of five minutes and a minimum angular resolution of one arc-minute. The spacecraft was launched on 18 October 1967 and the experiment has operated successfully through out its lifetime. The general scientific objectives of the telescope experiment are to study individual solar X-ray sources in several wavebands over an extended period, and to study the relationship of these sources to problems of solar physics. The routine data processing is described and the results to date of the scientific data analysis are summarized. A list of publications, and printout of three computer programs used in the data analysis are included.
Author

N71-34990*# North American Rockwell Corp., Downey, Calif. Space Div.
ERTS CLOUD COVER STUDY Final Report, Jan. 1970 - Mar. 1971
C. D. Martin and B. Liley Mar. 1971 303 p
(Contract NAS5-11231)
(NASA-CR-121770; SD-71-311) Avail: NTIS HC $6.00/MF $0.95 CSCL 03B

The results of a study to develop cloud statistics and probability-of-seeing values especially applicable to Earth Resources Technology Satellites (ERTS) are reported. Basic cloud statistics developed in a prior NASA-MSFC funded study were adjusted to the ERTS field-of-view and probability-of-seeing values were determined for single look, one- or two-look, and continuous viewing (look on every pass) modes. The cloud statistics adjustment for variable sensor resolution in terms of varisble sizes of cloud-free viewing elements was developed from U-2, Apollo, and ESSA photographs. The validity of the U.S. homogeneous cloud regions was studied and recommendations for improvement for ERTS viewing are made.
Author

N71-34991*# Bellcomm, Inc., Washington, D.C.
THE UNIVAC 1108 VIRTUAL MASS TRAJECTORY SIMULATION PROGRAM
R. F. Jessup 30 Mar. 1971 105 p refs
(Contract NASw-417)
(NASA-CR-121765; B71-03073) Avail: NTIS CSCL 22C

The Virtual Mass trajectory simulation program, VMASS, is a system of FORTRAN subroutines designed to aid in the analysis of spacecraft trajectories. It employs the Virtual Mass technique for numerical propagation or integration of the spacecraft state vector. This procedure which was developed to achieve high computational speed and precision, is documented. The subroutines implementing the Virtual Mass technique are presented. This implementation features user coded FORTRAN-like trajectory descriptions and output controls. In addition, it contains an integral link to standard JPL planetary ephemeris files.
Author

N71-34992*# IIT Research Inst., Chicago, Ill. Astron. Sciences.
HALLEY'S COMET FLYTHROUGH AND RENDEZVOUS MISSIONS VIA SOLAR ELECTRIC PROPULSION
A. L. Friedlander May 1971 109 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952701)
(NASA-CR-122099; T-28) Avail: NTIS CSCL 22A

The characteristics and capabilities of solar electric propulsion (SEP) are described for missions to Halley's Comet which is due to return in 1985-86. The 76 year period of this comet coupled with its large scientific and public interest makes this mission a rare and exciting opportunity. Trajectory/payload analysis and related requirements on flight time, launch vehicles, SEP powerplant size, propulsion on-time, and other SEP design characteristics are emphasized. The Halley mission opportunity is investigated over a very wide range of encounter conditions. These conditions are described primarily in terms of the spacecraft approach velocity relative to the comet (0-55 km/sec), and the arrival date (0-200 days before perihelion). SEP system parameters assumed in the study are representative of current technology and design goals. Baseline values are 30 kg/kw specific mass, 3500 sec specific impulse, 3 percent tankage fraction, and solar array power under 20 kw. The use of launch vehicles in the Titan family is emphasized.
Author

N71-34993*# Bureau of Mines, Spokane, Wash. Mining Research Center.
GRAVITY FLOW OF POWER IN A LUNAR ENVIRONMENT. 1: PROPERTY DETERMINATION OF SIMULATED LUNAR SOIL
David E. Nicholson Jul. 1971 38 p refs Sponsored by NASA
(NASA-CR-121670; RI-7543) Avail: NTIS CSCL 03B

The mechanical behavior of fine soils in a lunar environment in engineering gravity-flow bins is studied. The ultrahigh vacuum, absence of moisture,and a lunar gravity one-sixth that of earth gravity represents a unique environment, both advantageous and detrimental to these systems. The properties of a dry soil powder, its behavior under one-dimensional compression, and its torsional and direct shearing strength under earth atmosphere are described. Shear tests assess the failure criteria for the material. Compression tests provide modulus and stress-ratio values from the loading portion of the compression cycle, duplicating the condition of a bin at rest with the discharge closed. Assessment of the K stress-ratio value, over-consolidation ratio, a d the void ratio state is proposed as a criterion to determine the flowability of powder.
Author

N71-34994*# Tennessee Univ., Knoxville.
A STUDY OF SPACE CONTAMINATION BY MEANS OF THE SURFACE PLASMA RESONANCE EFFECT IN GRATING DIFFRACTION
James J. Cowan 1970 32 p refs
(Contract NAS8-25457)
(NASA-CR-121754) Avail: NTIS CSCL 03B

Studies were conducted to determine, both experimentally and theoretically, the surface plasma resonance effect in diffraction gratings with particular emphasis on the relation of this effect to the space contamination problem in spacecraft using gratings in optical instruments. Detailed descriptions of the studies are presented. A summary of the results indicates the following: (1) The surface plasma resonance effect can be used effectively to monitor the efficiency of a dielectric-coated grating; the only requirement an ability to scan the diffraction spectrum so that peak wavelength shifts can be detected. (2) Anomalous polarization phenomena can be used to measure optical constants of metals at wavelengths longer than the plasma wavelength.
D.L.G.

N71-34995*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
MINERALOGY AND PETROLOGY OF THE APOLLO 12 LUNAR SAMPLE
J. A. Wood, U. B. Marvin, J. B. Reid, Jr., G. J. Taylor, J. F. Bower et al 20 May 1971 285 p refs
(Contract NAS9-8106; Grant NGL-09-015-150)
(NASA-CR-121862; SAO-Special-Rept-333) Avail: NTIS CSCL 03B

A total of 499 coarse particles were sectioned, examined, and classified from five of the Apollo 12 soil samples: 12070, collected on the rim of Surveyor Crater; 12032 and 12037, from the rim of Bench Crater; 12033, from a light-colored layer in a trench dug in the rim of Head Crater; and 12001, collected between craters. Samples 12070 and 12001 appear to be

well-gardened soils, random mixtures of debris fragments, most of which derive from bedrock near at hand. The particles consist largely of mare basalts or degradation products thereof. Textures and mineral compositions of virtually all the basalt fragments examined point to their formation in one or more relatively thin lava flows. Soils 12032 and 12033 contain major amounts of a component alien to the local soil (as represented by 12070 and 12001) in the form of twisted, ropy particles of brownish glass. All the soils contain about 10% of particles that are noritic in composition (low-Ca pyroxenes and calcic plagioclase in nearly equal amounts), but most of these have the textures of thermally recrystallized microbreccias. Author

N71-34996*# Northeast Radio Observatory Corp., Westford, Mass. Haystack Observatory.
[RADIO AND RADAR ASTRONOMICAL OBSERVATIONS]
Quarterly Report
15 Jul. 1971 30 p refs Prepared in cooperation with MIT, Cambridge
(Contract NAS9-7830; Grants NGR-22-174-003; NSF GP-25865)
(NASA-CR-121866) Avail: NTIS CSCL 03A

Twenty radio astronomy investigations were continued active. Spectral line studies and very long baseline interferometer investigations continued to account for most of the programs at Haystack, though improvements in continum radiometers should foster additional programs in this area. In addition to the continuing measurements of lunar topography, detailed analyses of earlier radar backscattering data from the crater Alphonsus and the Apennine-Hadley region were conducted. In the planetary radar work, one interesting result was the finding of a region on Mars at about 18 deg South latitude which appeared to be of essentially constant elevation within + or - 250 meters over a 1500 km span in longitude. Author

N71-34997# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 257
30 Jul. 1971 66 p refs Transl. into ENGLISH from Russian Report
(JPRS-53726) Avail: NTIS

CONTENTS:

1. ASTRONOMY p 1-2 (See N71-34998 21-30)
2. METEOROLOGY p 3-15 (See N71-34999 21-30)
3. OCEANOGRAPHY p 16-20 (See N71-35000 21-30)
4. TERRESTRIAL GEOPHYSICS p 21-25 (See N71-35001 21-30)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 26-56 (See N71-35002 21-30)
6. LUNOKHOD-1 ON EARTH AND ON THE MOON p 57-61 (See N71-35003 21-30)

N71-34998# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astron., and Space, No. 257 30 Jul. 1971 p 1-2 refs (See N71-34997 21-30)
Avail: NTIS

News briefs and abstracts of articles concerning astronomy are reported. Topics presented include television telescope for astronomy, and temperatures of disturbed and undisturbed solar regions. F.O.S.

N71-34999# Joint Publications Research Service, Washington, D.C.
METEOROLOGY c20
In its Soviet Bloc Res. in Geophys., Astron., and Space, No. 257 30 Jul. 1971 p 3-15 refs (See N71-34997 21-30)
Avail: NTIS

News briefs and abstracts of scientific articles concerning meteorology are reported. Topics presented include: application of statistics in weather forecasting, predicting hail and thunderstorms, ozone studies, frontal cloud systems, and climatic characteristics of cloud cover. F.O.S.

N71-35000# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY c13
In its Soviet Bloc Res. in Geophys., Astron., and Space, No. 257 30 Jul. 1971 p 16-20 refs (See N71-34997 21-30)
Avail: NTIS

News briefs and abstracts of scientific articles concerning oceanography are reported. Topics presented include: description of Soviet bathyscaphe, sea bottom of Gulf of Guinea, satellite photographs of ice cover, and interaction between ocean and atmosphere. F.O.S.

N71-35001# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS c13
In its Soviet Bloc Res. in Geophys., Astron., and Space, No. 257. 30 Jul. 1971 p 21-25 refs (See N71-34997 21-30)
Avail: NTIS

News briefs concerning terrestrial geophysics are reported. Topics presented include: space filtering of seismic cross sections, automatic volume control for use in processing seismic waves, trigonometric leveling and gravimetric research in Antarctica. F.O.S.

N71-35002# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH c13
In its Soviet Bloc Res. in Geophys., Astron., and Space, No. 257 30 Jul. 1971 p 26-56 refs (See N71-34997 21-30)
Avail: NTIS

News briefs and abstracts of scientific articles concerning upper atmosphere and space research are presented. Topics discussed include: Selyut activities, death of the crew of Soyuz-11, launchings of Cosmos-427, and -428, and life beyond the earth. F.O.S.

N71-35003# Joint Publications Research Service, Washington, D.C.
LUNOKHOD-1 ON EARTH AND ON THE MOON
In its Soviet Bloc Res. in Geophys., Astron., and Space, No. 257 30 Jul. 1971 p 57-61 ref (See N71-34997 21-30)
Avail: NTIS

The design and operation of Lunokhod-1 are described. The available data on the mechanical properties of the lunar soil were used in computing traction which was tested on analogous soils. F.O.S.

N71-35004# Joint Publications Research Service, Washington, D.C.
SOVIET BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 258
13 Aug. 1971 46 p refs Transl. into ENGLISH from Russian reports
(JPRS-53818) Avail: NTIS

CONTENTS:

1. ASTRONOMY p 1-2 (See N71-35005 21-30)
2. METEOROLOGY p 3-13 (See N71-35006 21-30)
3. OCEANOGRAPHY p 14-18 (See N71-35007 21-30)
4. TERRESTRIAL GEOPHYSICS p 19-23 (See N71-35008 21-30)
5. UPPER ATMOSPHERE AND SPACE RESEARCH p 24-41 (See N71-35009 21-30)

N71-35005# Joint Publications Research Service, Washington, D.C.
ASTRONOMY
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, no. 258 13 Aug. 1971 p 1-2 refs (See N71-35004 21-30)
Avail: NTIS

Soviet news releases are presented on the annual heat balance determination of the northern polar cap of Mars and on spectrophotometric studies of giant planets. The solar and geomagnetic activity effects on Jovian decameter radio emission are also reported. J.A.M.

N71-35006# Joint Publications Research Service, Washington, D.C.
METEOROLOGY c20
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, no. 258 13 Aug. 1971 p 3-13 refs (See N71-35004 21-30)
Avail: NTIS

Soviet news releases are published on boundary layer physics of atmosphere and sea, reflectivity profile effect on accuracy of rain measurement, computer processing of radar meteorological data, and climate of late paleozoic age. The launching of a meteorological weather satellite is announced. Abstracts on various meteorological literature are also reported, including natural aerosol study of free atmosphere, optical characteristics of aerosol over oceans, and vertical distribution of descending long wave radiation. J.A.M.

N71-35007# Joint Publications Research Service, Washington, D.C.
OCEANOGRAPHY c13
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, no. 258 13 Aug. 1971 p 14-18 refs (See N71-35004 21-30)
Avail: NTIS

Soviet news releases are presented on processing measurements with sea gravimeters using Minsk-22 computer and gravimeter measurements in ocean polygon. A question and answer discussion concerning the Sever-2 underwater apparatus is given. Abstracts on various oceanographic literature are also cited, including heat content of the northern Pacific ocean and quaternary sedimentation in Argentinian basin. J.A.M.

N71-35008# Joint Publications Research Service, Washington, D.C.
TERRESTRIAL GEOPHYSICS c13
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, no. 258 13 Aug. 1971 p 19-23 refs (See N71-35004 21-30)
Avail: NTIS

A correlation study between pulsations of interplanetary magnetic field and intensity variations of stable pulsations of earth surface is outlined. Solar activity and velocity of interplanetary plasma, remote registry of weak tsunami waves, and temperature distribution in crust and top of mantle are briefly discussed, along with Baltic shield crustal structure. Thermopressure parameters in the atmosphere and ionosphere during magnetic storms are mentioned, as well as solar velocity and earth's electromagnetic field. J.A.M.

N71-35009# Joint Publications Research Service, Washington, D.C.
UPPER ATMOSPHERE AND SPACE RESEARCH c13
In its Soviet Bloc Res. in Geophys., Astronomy, and Space, no. 258 13 Aug. 1971 p 24-41 refs (See N71-35004 21-30)
Avail: NTIS

The continuing movement of Lunokhod-1 is reported. Depressurization was determined as the cause of death of the Soyuz-11 flight crew. The launching of Cosmos 429 is announced, along with normal functioning systems of the orbital scientific station. Abstracts of various aerospace and atmospheric literature are presented, including indirect determination of vertical water vapor profile, transformation of ascending thermal radiation, and azimuthal distribution of atmospheric radiation. J.A.M.

N71-35010 National Lending Library for Science and Technology, Boston Spa (England).
NEWS OF SCIENCE AND TECHNOLOGY
A. Zhaichenko et al 8 Apr. 1971 3 p
(NLL-M-20585-(5828.4F)) Avail: Natl. Lending Library, Boston, Spa, Engl: 1 NLL photocopy coupon

The mammouth radio telescope, designed for investigations in the decimeter wave band of stellar atmospheres, is described. E.H.W.

N71-35011# Columbia Univ., New York. Dept. of Astronomy.
MAGNETIC FIELDS IN STARS AND GALAXIES. RADIATION PROCESSES AND INTERACTION WITH IONIZED MATERIAL IN MAGNETIC FIELD Final Report, 1 Feb. 1964 - 31 Jan. 1971
L. Woltjer Apr. 1971 14 p refs
(Contract AF 49(638)-1358)
(AD-722871; AFOSR-71-1100TR) Avail: NTIS CSCL 03/2

The report covers research from 1964 to 1971. Results are listed and discussed, including; magnetic fields in stars and stellar evolution of white dwarf and neutron stars, magnetic fields and gas flows in galaxies, supernova remnants, quasars, X-ray sources and cosmic rays. Publications are listed. Author (GRA)

N71-35012# Specola Vaticana (Vatican City).
TWELVE VARIABLE STARS IN THE CYGNUS CLOUD, VV 251-262
Walter J. Miller (Fordham Univ.) 1970 19 p *Its* Ric. Astronomiche, Vol. 8, No. 8
(Grant NSF GP-7962)
Avail: NTIS

Five old and seven new variable stars were studied on a total of 9114 plates from the Vatican, Hamburg, Heidelberg, Harvard and Hale Observatories. Seven of the stars are eclipsing variables, one is an RR Lyrae, two are SR or Irregular Red variables, and the other two are peculiar types. The results are summarized in six tables and five pages of either fragmentary or mean light curves. Author

N71-35013# Fordham Univ., New York. Astronomical Lab.
EIGHT NEW VARIABLE STARS IN THE CYGNUS CLOUD, VV 263-270
Walter J. Miller, Jr. 1970 16 p refs *Its* Ric. Astronomiche Vol. 8, No. 9
(Grant NSF GP-7962)
Avail: NTIS

Eight new variable stars were studied on a total of 7842 plates from the Vatican, Hamburg, Heidelberg, Harvard and Hale Observatories. Three of the stars are irregular red variables, one is either an RRc or W U Ma variable, and four are algol eclipsing variables. The results are summarized in four tables of data and five pages of either fragmentary or mean light curves. Author

N71-35014# Smithsonian Astrophysical Observatory, Cambridge, Mass.
THE VARIABLE STARS OF THE LARGE MAGELLANIC CLOUD
Cecilia H. Payne-Gaposchkin Washington 1971 43 p refs *Its* Smithsonian Contrib. to Astrophys. No. 13
(Grant NSF GP-4638)
Avail: SOD $0.50

The variable stars in the Large Magellanic Cloud were studied on the basis of estimates made from available photographic plates. of the 2184 stars measured, 1830 were judged to be variable. Numerical data derived from a discussion of the material are listed in tabular form. Author

N71-35015# Joint Publications Research Service, Washington, D.C.
NUMERICAL MODELING OF THE CIRCULATION OF THE

VENUSIAN ATMOSPHERE
S. S. Zilitinkevich et al 3 Sep. 1971 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 1291-1294
(JPRS-53985) Avail: NTIS

A mathematical model of the circulation of the atmosphere around Venus is discussed. Complete hydrodynamic equations of a sphere in quasi-static approximation with dimensionless pressure as a vertical coordinate and discontinuity and heat flux equations with four independent variables (latitudinal and meridional velocity components and potential surface temperature and pressure components) were utilized in the calculations. Horizontal mixing was accounted for by using Richardson's law. Vertical pulse and heat flows in the boundary layer were also included. Radiation heat fluxes were calculated from a Greenhouse model of the Venusian atmosphere. J.M.

N71-35016# National Center for Atmospheric Research, Boulder, Colo.
THE TURBULENT DYNAMO
F. Krause et al Jun. 1971 324 p refs Transl. into ENGLISH from various West German journals Sponsored by NSF
(NCAR-TN/IA-60) Avail: NTIS HC $6.00/MF $0.95

Abstracts and translations of fourteen papers concerning the turbulent dynamo theory in cosmological electrodynamics are presented. Electromotive forces, magnetohydrodynamic turbulence, coriolis forces, turbulent conductivity and permeability, and stellar and planetary magnetic fields in relation to the turbulent dynamo theory are covered. J.M.

N71-35017 National Lending Library for Science and Technology, Boston Spa (England).
THUNDERSTORMS ON THE MOON?
D. A. Frank-Kamenetskii [1971] 4 p Transl. into ENGLISH from Priroda (USSR.), v. 10, 1970 p 98
(NLL-M-20719-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Emission bands of H2, C2, and N2 molecules have been detected in the radiation emitted by short-lived red flares on parts of the moon's surface. Various explanations for this phenomenon are reviewed and a recent dust thunderstorm hypothesis is discussed in detail. Author

N71-35018*# National Aeronautics and Space Administration, Washington, D.C.
MANNED SPACE FLIGHT: NEWS RELEASE
Mar. 1971 7 p
Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22B

An updated report is presented covering the Apollo, Skylab, Space Station, and Space Shuttle programs. Information contained includes: (1) mission descriptions, (2) flight schedules, (3) crew members, (4) program officials, (5) funding data, and (6) principal contractors. D.L.G.

N71-35019 California Inst. of Tech., Pasadena.
A SPECTROSCOPIC INVESTIGATION OF FOUR O-TYPE SUBDWARFS
Arsine Victoria Peterson (Ph.D. Thesis) 1970 166 p
Avail: Univ. Microfilms Order No. 70-18044

The spectra of four O-type subdwarfs, of the class with strong nitrogen lines and very weak carbon and oxygen lines, have been studied in some detail. Model atmospheres have been constructed for the stars HZ 44, +28 deg 4655, and HD 127493, and the computed profiles of selected hydrogen and helium lines have been compared with the observed profiles. High helium abundances have been inferred for these stars; from Y approximately = 0.4 for HZ 44 to Y approximately = 0.9 for +28 deg 4655. Chemical abundances have been derived for heavier elements in a fine analysis. The nitrogen to carbon, and nitrogen to oxygen ratios derived for these stars are two orders of magnitude greater than is observed in the sun and in other main sequence stars. The high helium abundance and the observed CNO ratios are consistent with abundances predicted for material which has undergone hydrogen burning in the CNO cycle. Dissert. Abstr.

N71-35020 California Inst. of Tech., Pasadena.
INFRARED OBSERVATIONS OF H II REGIONS
Theodore William Hilgeman (Ph.D. Thesis) 1970 198 p
Avail: Univ. Microfilms Order No. 70-18037

Spectral data are presented, giving intensities of the Brackett gamma B7 line at six positions in M 42 and of the Brackett ten through fourteen lines plus the He 4d3 D to 3p3 PO transition line at three positions in M 42. Observations of the Brackett gamma line are also given for the planetary nebulae NGC 7027 and IC 418. Brackett gamma is shown to exhibit an anomalous satellite line in NGC 7027. Broadband data are presented, giving intensities at effective wavelengths of 1.25, 1.65, 2.2, 3.5, and 4.8 microns for three positions in M 42. Comparisons with visual and radio data as well as 12 micron and 20 micron data are used to derive reddening, electron temperatures, and electron densities for M 42 and the two planetaries, as well as a helium abundance for M 42. M 42 is shown to emit in excess of the predicted recombination radiation throughout the entire infrared spectrum. A new feature of the Orion red star ORS-1 is found in that it appears to have a reflection nebula around it. Dissert. Abstr.

N71-35021 California Inst. of Tech., Pasadena.
THERMAL INSTABILITY AND THE CONVECTIVE STABILITY OF STELLAR CHROMOSPHERES
Richard John Defouw, (Ph.D. Thesis) 1970 107 p
Avail: Univ. Microfilms Order No. 70-18033

It is shown that the Schwarzschild criterion does not apply to stellar chromospheres because it ignores the possibility of thermal instability. In the absence of a magnetic field, thermally unstable regions of a chromosphere will be overstable if the temperature inversion is sufficiently steep. This overstability may explain the origin of a certain class of oscillations in the solar chromosphere. Thermally unstable regions containing magnetic fields are monotonically unstable for all values of the temperature gradient. It is suggested that this monotonic instability of magnetic regions is responsible for spicule formation in the solar chromosphere. Elementary considerations of thermal balance predict that the temperature gradient should diverge at levels of marginal stability. The chromospheric region of spicule formation should therefore be bounded below by an abrupt temperature jump. These results are derived by analyzing the stability of a simple model chromosphere in which all neutral hydrogen atoms are assumed to be in the ground state.
Dissert. Abstr.

N71-35022 Texas Univ., Austin.
OPTIMAL THREE DIMENSIONAL REENTRY TRAJECTORIES FOR APOLLO TYPE VEHICLES
Walton E. Williamson, Jr. (Ph.D. Thesis) 1970 148 p
Avail: Univ. Microfilms order no. 70-18312

A numerical optimization method, the perturbation method, is used to calculate optimal three dimensional reentry trajectories for Apollo type vehicles. A linear combination of the convective heating and the integral of the acceleration are minimized. The only control of the vehicle is the roll angle which specifies the orientation of the lift vector. The initial conditions for reentry are chosen to correspond to those encountered by an Apollo vehicle returning to the earth from a lunar mission. Specified terminal conditions are consistent with those required just prior to the opening of a drogue parachute. Optimal trajectories obtained with the conditions described above are skip trajectories with high acceleration peaks. State variable inequality constraints are required in order to produce trajectories without these characteristics. The perturbation method is modified so that it may be used to calculate optimal trajectories with state variable inequality constraints. Dissert. Abstr.

N71-35023 Florida Univ., Gainesville.
WAVEFORM AND SOURCE-SIZE STUDIES OF JUPITER'S DECAMETRIC RADIATION
Madhabendra Prasad Paul (Ph.D. Thesis) 1969 145 p
Avail: Univ. Microfilms Order No. 70-14908

The Jovian decametric radiation was studied using a long baseline radio interferometer. Jovian S bursts are both recurrent and noncurrent. Statistical analyses of the duration and separation of these bursts and their relationship with System III (1957.0) longitude were made. There is no significant difference between the different types of radio noise within Jovian bursts. An experiment was conducted to measure the frequency drift of S bursts using fixed frequency receivers. Measurements were carried out to determine peak flux density of S bursts and to estimate the angular diameter of Jovian decametric sources, using an interferometer of 880 km baseline. The cross correlation coefficient between corresponding pairs of S bursts was calculated. No significant arrival time difference was found between a pair of S bursts received at the two ends of the baseline. The abundance of S bursts in Jovian radio noise associated with sources B and C is related to the conductivities of Jovian ionosphere at the foot of the flux tube passing through Io. Dissert. Abstr.

N71-35024 Stanford Univ., Calif.
THREE SPACE VEHICLE ATTITUDE STABILITY PROBLEMS
Elbert Lynn Marsh (Ph.D. Thesis) 1970 118 p
Avail: Univ. Microfilms Order No. 70-18444

Three attitude stability problems are presented. Two of these deal with an axisymmetric satellite in orbit about a single attracting body and the third is concerned with an axisymmetric satellite under the influence of two attracting bodies. A solution of the full non-linear attitude equations of motion can be found and the question of stability may then be investigated by considering a linearized version of a perturbation of this solution. It is found that factors affecting this stability are the attracting body's shape, the initial satellite mass center displacement in the attracting body's equatorial plane, the satellite's spin rate, and inertia properties. In the second problem, attitude stability of a spinning, symmetric body whose mass center moves on a hyperbolic orbit under the gravitational action of a fixed particle is studied by means of numerical integrations of the equations of motion of the satellite. The third problem is concerned with the attitude stability of a small spinning satellite in the vicinity of two large bodies which move in circular orbits about their mass center. Five orbit equilibrium positions for the satellite are possible. Dissert. Abstr.

N71-35025 Wisconsin Univ., Madison.
PULSATIONAL CHARACTERISTICS OF A LOW MASS CEPHEID MODEL INCLUDING CONVECTION EFFECTS
Eric Manning Jones (Ph.D. Thesis) 1970 47 p
Avail: Univ Microfilms Order No. 70-13918

Pulsational characteristics of a low mass cepheid model to include convection effects are presented. The model parameters are: mass 0.93 M sub o, M sub bo = minus 1.7, and logarithm T sub e = 3.75. Convection is treated by a time dependent mixing length type theory where eddy velocity is assumed to exponentially approach the equilibrium value computed in Bohm-Vitense's formulation. The model is found to be marginally unstable to pulsation driven by the hydrogen ionization zone.
Author

N71-35026 California Univ., Berkeley.
STUDIES OF INTERSTELLAR EXTINCTION AT INFRARED WAVELENGTHS
Roger Fritz Knacke (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms Order No. 70-17596

A study of interstellar extinction between 1 and 12 microns has been made. Calculations are presented for extinction cross sections for grains composed of water ice, quartz, silica, and graphite and silica surrounded by an ice mantle. Laboratory spectra of the position, strength, and shape of the strong ice band at 3.07 microns confirm that the calculations are valid for ice at interstellar temperatures. Infrared spectra of the reddened stars VI Cyg No. 12, CIT 11, HD 183143, and 119 Tau were obtained to test the theoretical predictions. No absorption band at 3.07 microns stronger than 10, 50, and 20 percent, respectively, of the expected absorption of ice grains can be fitted to the spectra of these stars. It is concluded that the interstellar grains contain very little ice. Dissert. Abstr.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-35027*# Martin Marietta Corp., Denver, Colo.
DEVELOPMENT OF A TEST AND FLIGHT ENGINEERING ORIENTED LANGUAGE, PHASE 2 REPORT Interim Report, Sep. - Oct. 1970
W. F. Kamsler, C. W. Case, E. L. Kinney, and J. Gyure Oct. 1970 91 p refs
(Contract NAS10-7308)
(NASA-CR-121616; MCR-70-365) Avail: NTIS CSCL 22B

An analysis was performed of the space shuttle system and those requirements which impact on the development of a test and flight engineer language are detailed. The necessary resulting language characteristics were analyzed and reasons are given as to why they are necessary in the proposed test oriented language. Author

N71-35028*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Space Systems Div.
PAYLOAD EFFECTS ANALYSIS Final Summary Report
30 Jun. 1971 54 p
(Contract NASw-2156)
(NASA-CR-121499; LMSC-A990594) Avail: NTIS CSCL 22B

Concepts for reducing cost of future NASA payloads to be used with the new space transportation system were studied. The study was limited to NASA unmanned payloads, and because of the need for validity in the study results, only those payloads which had flown and upon which historical design and program cost data were available were considered as candidate baseline payloads. Author

N71-35029*# Martin Marietta Corp., Denver, Colo.
DEVELOPMENT OF A TEST AND FLIGHT ENGINEERING ORIENTED LANGUAGE
W. F. Kamsler, C. W. Case, J. Gyure, and E. L. Kinney Oct. 1970 49 p
(Contract NAS10-7308)
(NASA-CR-121657; MCR-70-381) Avail: NTIS CSCL 22B

The material used during the oral presentation to describe the work done in Phase 2 on the development of a test and flight engineer oriented computer language for the space shuttle system is presented. Author

N71-35030*# Martin Marietta Corp., Denver, Colo.
SPIN VECTOR CONTROL FOR A SPINNING SPACE STATION, VOLUME 1: USER'S MANUAL
T. Hendricks, Walter Guderian, George Haynes, and Gary Johnson Nov. 1970 279 p
(Contract NAS8-25247)
(NASA-CR-121723; MCR-70-457-Vol-1) Avail: NTIS CSCL 22B

The formulation, computational logic, input/output options, subroutine description, and other pertinent information that should aid the user of the Spin Vector Control Computer

Program (MD246) are presented. The design, use, and implementation of a digital computer program to facilitate the study of the dynamic behavior and control of dual spin space vehicles is emphasized. For Volume 2, see N71-20483. Author

N71-35031*# Grumman Aerospace Corp., Bethpage, N.Y.
OAO/LST SHUTTLE ECONOMICS STUDY, VOLUME 1
1 Oct. 1970 180 p ref 2 Vol.
(Contract NAS5-17149)
(NASA-CR-121703) Avail: NTIS CSCL 22A

The effects of utilizing the space shuttle upon the cost of the OAO/LST point design spacecraft and upon the mission objectives and operational modes of the program were studied. Results are reported for the following tasks undertaken in the study: establishment of baseline costs of the OAO/LST point design for the Titan launched program identification and assessment of the effects of the space shuttle on these baseline costs; evaluation of the interrelationships between shuttle utilization, useful observing time, and OAO/LST program costs; and analysis of total program costs for comparative OAO/LST programs with and without the shuttle. Author

N71-35032*# Grumman Aerospace Corp., Bethpage, N.Y.
OAO/LST SHUTTLE ECONOMICS STUDY, VOLUME 2
1 Oct. 1970 208 p ref 2 Vol.
(Contract NAS5-17149)
(NASA-CR-121702) Avail: NTIS CSCL 22A

The proposal for an OAO/LST shuttle economic study consisted of the following parts: study guidelines and constraints; shuttle interface considerations; statement of work; task flow diagram; schedule; and cost and pricing summary of financial information. The study is to involve the generation of a complete cost model of an OAO/LST based on the GSFC point design spacecraft and launched in what has been considered the conventional manner employing an expandable booster, the Titan 3-C. This baseline cost model will undergo several iterations based on possible changes resulting from the introduction of the concept of an EOS available for initial launch, deployment, resupply, and retrieval. The effects of this EOS availability on the design and operation of the OAO/LST spacecraft and the resultant sensitivity to the program costs will be presented. Author

N71-35033*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SMALL APPLICATIONS TECHNOLOGY SATELLITE (SATS) Interim Study Report
May 1970 130 p
(NASA-TM-X-67259) Avail: NTIS CSCL 22B

The Small Applications Technology Satellite (SATS) program is proposed to expedite the development of sensors, experiments, and spacecraft technology and systems through orbital flight testing of components, subsystems, and system parameters. The following guidelines are outlined: rationale, objectives and justifications for a SATS program, potential experiments and disciplines for SATS flights, past and present spacecraft for applicability of available designs or hardware to SATS, time and cost effectiveness of a SATS program relative to other programs, and alternate SATS spacecraft concepts including a pilot spacecraft program. E.M.C.

N71-35034*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PROCEEDINGS OF THE SPACE SHUTTLE INTEGRATED ELECTRONICS CONFERENCE, VOLUME 2
1971 365 p refs Conf. held in Houston, Tex., 11-13 May 1971
(NASA-TM-X-58063-Vol-2) Avail: NTIS CSCL 22B

CONTENTS:

1. AIR DATA SENSING FOR SPACE SHUTTLE D. J. Sowada, F. A. Moynihan, R. G. Bailey, and A. Hafner (Honeywell, Inc., St. Paul, Minn.) p 3-36 (See N71-35035 21-14)

2. ZERO-G PROPELLANT GAUGING OF CRYOGENICS R. G. Morrison (TRW Systems Group, Redondo Beach, Calif.) 37-52 (See N71-35036 21-27)

3. ZERO-G RADIO FREQUENCY GAGING SYSTEM FOR SPACE SHUTTLE PROPELLANT TANKS N. E. Stanley, B. J. Hebler, W. Ott (Bendix Corp., Davenport, Iowa), and H. E. Thompson p 53-72 (See N71-35037 21-27)

4. SHUTTLE SENSORS V. C. Melliff, Jr. and A. T. Linton (NASA, Manned Spacecraft, Houston, Texas) p 73-104 (See N71-35038 21-14)

5. SOLID-STATE POWER CONTROLLERS J. C. Boykin, W. C. Stagg, and D. E. Williams (NASA, Manned Spacecraft, Houston, Texas) p 106-132 (See N71-35039 21-09)

6. AN AUTOMATIC ELECTRICAL DISTRIBUTION SYSTEM M. A. Geyer (Westinghouse Elec. Corp., Lima, Ohio) p 133-142 (See N71-35040 21-10)

7. SPACE SHUTTLE CONNECTOR DEVELOPMENT B. J. McPeak and W. J. Shockley (NASA, Marshall Space Flight Center, Huntsville, Ala.) p 143-176 refs (See N71-35041 21-09)

8. SPACE SHUTTLE ELECTRIC POWER DISTRIBUTION CONSIDERATIONS J. L. Felch (NASA, Marshall Space Flight Center, Huntsville, Ala.) p 177-182 (See N71-35042 21-09)

9. A SOLUTION FOR THE SPACE SHUTTLE HIGH TEMPERATURE ANTENNA PROBLEM E. A. Kuhlman (McDonnell-Douglas Co., St. Louis, Mo.) p 185-202 (See N71-35043 21-07)

10. ANTENNA TECHNOLOGY: MATERIALS FOR ANTENNA PROTECTIVE COATINGS M. X. Gilreath (NASA, Langley Res. Center, Hampton, Va.) p 203-222 (See N71-35044 21-07)

11. ANTENNA TECHNOLOGY: ANTENNA DESIGN AND SCALE MODEL TECHNIQUES W. F. Croswell (NASA, Langley Res. Center, Hampton, Va.) p 223-244 (See N71-35045 21-07)

12. AUTOMATIC ANTENNA SWITCHING TECHNIQUES H. D. Cubley (NASA, Manned Spacecraft Center, Houston, Tex.) 245-278 (See N71-35046 21-07)

13. SPACECRAFT INTEGRATED PARAMETRIC AMPLIFIER DEVELOPMENT P. H. Dalle Mura (NASA, Goddard Space Flight Center, Greenbelt, Md.) p 279-2902 refs (See N71-35047 21-09)

14. LOW-RATE COMMUNICATIONS UTILIZING DIGITAL CODING AND MODULATION B. H. Batson, C. K. Land, and R. W. Moorehead (NASA, Manned Spacecraft Center, Houston, Tex.) p 291-310 (See N71-35048 21-07)

15. COMPRESSION AND ERROR CORRECTION FOR TV R. B. Blizard, W. A. Stevens, J. L. McKinney, H. M. Gates, W. B. Anthony et al (Martin Marietta, Denver, Colo.) p 311-328 refs (See N71-35049 21-07)

16. INTEGRATION OF RADIO FREQUENCY FUNCTIONS FOR NAVIGATION VOICE AND DATA COMMUNICATION T. S. Bettwy (TRW Systems Group, Redondo Beach, Calif.) 329-362 (See N71-35050 21-07)

17. MICROWAVE TRAVELING WAVE TUBE AMPLIFIERS FOR SPACE COMMUNICATIONS SYSTEMS B. M. Kendall (NASA, Langley Res. Center, Hampton, Va.) p 363-369 (See N71-35051 21-07)

N71-35035*# Honeywell, Inc., St. Paul, Minn.
AIR DATA SENSING FOR SPACE SHUTTLE Interim Report c14
Delroy J. Sowada, Frederich A. Moynihan, Ronald G. Bailey, and Alex Hafner (NASA, Marshall Space Flight Center) *In* NASA, Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 3-36 3 Vol. (See N71-35034 21-31)
(Contract NAS8-26326)
Avail: NTIS CSCL 22B

The feasible and useful air data sensing alternatives in terms of potential uses, practical mechanization, and primary impact related to the current configuration of the space shuttle vehicle and avionics are described. Recommendations are made to provide a baseline air data measurement system for

integration into the shuttle vehicles. The state-of-the-art feasibility of the recommended system is substantiated by flight experience, wind tunnel tests, and simulation studies. Author

N71-35036*# TRW Systems Group, Redondo Beach, Calif.
ZERO-g PROPELLANT GAUGING OF CRYOGENICS c27
R. G. Morrison *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 37-52 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

Two systems of determining propellant quantity of specific cryogens under conditions of weightlessness were investigated. The systems were the resonant infrasonic gauging system (RIGS) and the nucleonic gauging system (NGS). The nucleonic system offers a distinct advantage in measuring propellant quantity since it requires no electrical penetration of the cryogenic tank. The RIGS has many unanswered questions regarding cryogenic applications. It is not a candidate for liquid hydrogen systems, however, it may be adapted to LOX. If a system can be designed which will preferentially position the liquid, ultrasonic systems may prove to be the simplest and least expensive. A.L.

N71-35037*# Bendix Corp., Davenport, Iowa.
ZERO-g RADIO FREQUENCY GAGING SYSTEM FOR SPACE SHUTTLE PROPELLANT TANKS c27
H. E. Thompson (NASA. Marshall Space Flight Center), N. E. Stanley, B. J. Shebler, and W. Ott *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 53-72 Supported by NASA, Marshall Space Flight Center 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

Progress of RF gaging and its applicability to space shuttle propellant gaging systems are presented. Included are basic theory, analysis, test results to substantiate theory and analysis, along with test data from systems built and tested to date. Also included are tank and fluid orientation data with characteristic performance curves, repeatability, and system accuracy. Some problem areas and their solutions are applicable to space shuttle mission capability enhancement are also presented. Author

N71-35038*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SHUTTLE SENSORS c14
Vernon C. Melliff, Jr. and Arthur T. Linton (Boeing Co., Houston, Tex.) *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 73-104 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

The typical shuttle environments that constrain the performance of the required shuttle sensors are described. The maximum environmental temperatures for sensors are expected to be -300 F to +650 F for large portions of the wing area and fuselage. The new high temperature materials present many unique sensor design problems with regard to sensor installation and calibration. Operational requirements of the shuttle sensors are much more stringent than of previous spacecraft; life expectancy of 10 years, 100 missions between major repair work, and rapid turnaround time between missions (2 weeks limit). With consideration of the shuttle requirements, pressure, temperature, strain, acceleration, vibration, and acoustic transducers are discussed, along with their inherent design deficiencies and suggested methods and approaches for solution of these deficiencies. Author

N71-35039*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SOLID-STATE POWER CONTROLLERS c09
Jack C. Boykin, William C. Stagg, and Donald E. Williams *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 106-132 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

Potential improvements in the power distribution and control subsystem which is being strongly considered for the space shuttle program and system interface requirements, the SSPC (solid state power controller), are discussed. The basic functions of the SSPC, some of the basic design concepts thus far evolved for performing these functions, and some of the considerations involved in both the design and application of these devices are presented. Spacecraft systems requirements as well as the potential results of applying SSPC's in an approach to meeting these requirements are discussed. Also presented is the development status of SSPC's to date, along with the requirements for further development of the devices, systems, and concepts necessary to take full advantage of this technology. Author

N71-35040*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
AN AUTOMATIC ELECTRICAL DISTRIBUTION SYSTEM c10
M. A. Geyer *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 133-142 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

The automatically controlled electrical system (ACES) is a new method of distributing and controlling electrical power. It utilizes remotely controlled power switching and circuit protective devices. Control is exercised through a small general purpose computer using multiplexed control signals. This computer directs the control signals to and from the appropriate system control devices. In addition, it is programmed for automatic control, sequencing, and self-checkout functions. The system offers numerous potential benefits such as: (1) reduced wiring weight and complexity; (2) reduced manual supervision; (3) lower overall cost; (4) less susceptibility to human error; (5) fewer bulkhead penetrations; (6) simplified maintenance; (7) programming of load availability under conditions of low power availability; and (8) greatly simplified means for system growth and modification; ACES is currently being developed for aircraft and spacecraft applications. Author

N71-35041*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE CONNECTOR DEVELOPMENT c09
B. J. Mc Peak and W. J. Shockley *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 143-176 refs refs 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

Some of the problems associated with the standard and upgraded electrical connectors used in the space programs are discussed along with some of the research and development progress on new and improved connectors for use in the Skylab and space shuttle programs. A.L.

N71-35042*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPACE SHUTTLE ELECTRIC POWER DISTRIBUTION CONSIDERATIONS c09
J. L. Felch *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 177-182 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

The development of the space shuttle electric power distribution system is examined considering the state-of-technology. A brief review of conventional air and spacecraft electrical power systems is discussed, and the advantages of a new approach are described. The objectives of MSFC's advanced development studies devoted to this technology area are described. A recommended philosophy of approach for the space shuttle electric power distribution system is expressed. Author

N71-35043*# McDonnell-Douglas Co., St. Louis, Mo.
A SOLUTION FOR THE SPACE SHUTTLE HIGH TEMPERATURE ANTENNA PROBLEM c07
E. A. Kuhlman *In* NASA. Manned Spacecraft Center Proc. of

the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 185-202 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

The development of high temperature antennas is one of the more difficult space shuttle problems. The avionics system onboard the space shuttle orbiter and booster use frequencies which are used on commercial and military airplanes. The high temperature antennas previously developed for reentry vehicle applications are for other frequencies, and were designed for one shot application. Therefore, the techniques which have been developed for high temperature reentry vehicle antennas may not be directly applicable to the reusable requirements of space shuttle. This leaves the designer in the position of applying both new and old techniques to antenna types which have not previously been designed for operation at reentry temperatures.
Author

N71-35044*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANTENNA TECHNOLOGY: MATERIALS FOR ANTENNA PROTECTIVE COATINGS c07
M. C. Gilreath *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 203-222 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

Research efforts directed toward the selection of materials having suitable thermal and dielectric properties to cover flush mounted antennas on the space shuttle vehicle are discussed. Described in detail are: (1) selection of candidate materials; (2) measurement of dielectric properties of candidate materials at room temperature, as a function of temperature up to 2000 F, and during temperature recycling tests; (3) evaluation of candidate materials during exposure to space shuttle heating rates in arc tunnel; and (4) investigation of material breakdown during simultaneous exposure to high surface temperature and high RF power levels.
Author

N71-35045*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANTENNA TECHNOLOGY: ANTENNA DESIGN AND SCALE MODEL TECHNIQUES c07
W. F. Croswell *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 223-244 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

Development of prototype antenna designs and methods of measuring and predicting antenna characteristics when mounted on large complex shapes such as space shuttles are discussed. The technique used consisted of: (1) choosing typical antenna types that meet space shuttle requirements; (2) developing analytical methods for computerized design of such antennas; and (3) checking design methods by use of scale models of space shuttle shapes.
Author

N71-35046*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
AUTOMATIC ANTENNA SWITCHING TECHNIQUES c07
H. Dean Cubley *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 245-278 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

A development program is described that has as its purpose the optimization of the communications antenna performance of the orbiter portion of the shuttle vehicle. The basic configuration of the communications antennas on the shuttle is discussed in view of the presently anticipated communications requirements. The design problems associated with the placement of shuttle antennas and the possible effects of interference between antennas are explored. A proposal is made that some type of switching system for antenna control must be a basic part of any shuttle design. The basic types of antenna control systems are reviewed with emphasis on their applicability to the shuttle requirements. The results of an extensive comparative analysis of all of these basic systems and certain of their hybrid combinations are presented. The development of engineering models of some of the most interesting of these antenna control systems is discussed in relation to their adaptation to the shuttle requirements. The present MSC in-house test program being conducted on these engineering models is discussed, and some of the results of these tests are presented. A summary of the additional planned development and testing objectives of this program is presented.
Author

N71-35047*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPACECRAFT INTEGRATED PARAMETRIC AMPLIFIER DEVELOPMENT c09
P. H. Dalle Mura *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 279-290 refs 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

An integrated, solid state paramp for utilization aboard the space shuttle has been developed through the initial prototype phase. The paramp is tunable over the entire 3.7 GHz to 4.2 GHz commercial satellite communications band, has a instantaneous bandwidth of 100 MHz minimum when tuned over the band, a gain of 17 dB, and a noise figure ranging from 104 K at the low end to 150 K at the high end of the band. The paramp utilizes a combination of microstrip, coax, and waveguide circuitry in an extremely compact and lightweight package. The paramp weighs seven ounces and has a volume of less than six cubic inches. It is completely operational when supplied with seven volts dc at 0.6 ampere. A comparison of the development of this second generation unit with a first generation S-band paramp is presented. Measured test results of the two units are analyzed to show how deficiencies in the first generation paramp were eliminated in the second development. A prototype Ku-band spacecraft paramp being developed for the TDRS Program is described.
Author

N71-35048*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
LOW-RATE COMMUNICATIONS UTILIZING DIGITAL CODING AND MODULATION c07
B. H. Batson, C. K. Land, and R. W. Moorshad *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 291-310 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

A highly efficient all-digital communications signal design employing convolutional coding and optimum (PSK) modulation is described for two-way transmission of voice and low rate (several kbps) data between the space shuttle and ground. Variable slope delta modulation is selected for analog/digital conversion of the voice signal. A convolutional decoder based on the Viterbi decoding algorithm is selected for use at the receiving terminal. Performance predictions (both theoretical and experimental) are presented for transmission via the Intelsat 4 relay satellite system, with application of state-of-the-art technology to the space shuttle RF system. Hardware estimates are provided for an actual flight-qualified communications system employing the coded digital signal design.
Author

N71-35049*# Martin Marietta Corp., Denver, Colo.
COMPRESSION AND ERROR CORRECTION FOR TV c07
R. B. Blizard, W. A. Stevens, J. L. Mc Kinney, H. M. Gates, W. B. Anthony et al *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 311-328 refs 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

The feasibility of digital transmission of real time, standard format TV, together with voice and all the other data that must be returned from the Apollo spacecraft was investigated. The principal benefit offered by a digital system is a reduction in the RF power required to transmit a good picture and reliable data. To achieve this improvement it is necessary to use two techniques, always considered together, made possible by

converting to an all-digital system: error correcting codes and data compression. Data compression makes each transmitted bit more important so that fewer errors can be tolerated, and error correction gives more improvement as low error rates. Author

N71-35050*# TRW Systems Group, Redondo Beach, Calif.
INTEGRATION OF RADIO FREQUENCY FUNCTIONS FOR NAVIGATION, VOICE AND DATA COMMUNICATION c07
T. S. Bettwy *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 329-362 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

The advent of the space shuttle project has produced requirements for both communication and navigation functions that were nonexistent for the Apollo project. These functions are associated with landing at an airport. Although the new functions can readily be accomplished with traditional (FAA type) systems, a much more cost effective approach is proposed. This technique, called USCANS for Unified S-Band Communication and Navigation System, makes maximum use of existing NASA equipment, can be employed on other NASA projects such as Skylab, space station, and FFP and increases shuttle system performance during on-orbit phases. The proposed system is also compatible with the Air Force's Satellite Control Network. Author

N71-35051*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
MICROWAVE TRAVELING WAVE TUBE AMPLIFIERS FOR SPACE COMMUNICATIONS SYSTEMS c07
Bruce M. Kendall *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 363-369 3 Vol. (See N71-35034 21-31)
Avail: NTIS CSCL 22B

The program to develop microwave traveling wave tube amplifiers (TWTA) for the communications subsystem of the space shuttle vehicle, utilizing presently available techniques and tube designs, is discussed. An engineering model of a C-band 100-watt TWTA will be developed for the space shuttle communications subsystem and will be compatible with Intelsat 4. This initial phase will also produce firm specifications for amplifier design and assure compatible transmitter and antenna requirements. These specifications will also be used to generate the second phase of the development program which will be the fabrication of units for flight qualification and life testing. Upon completion of the C-band TWTA development phases, the same technology will be used to develop TWTA's at Ku-band for utilization by the tracking Data Relay Satellite. Author

N71-35052*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
PROCEEDINGS OF THE SPACE SHUTTLE INTEGRATED ELECTRONICS CONFERENCE, VOLUME 3
1971 383 p ref Conf. held in Houston, Tex., 11-13 Mar. 1971 3 Vol.
(NASA-TM-X-58063-Vol-3) Avail: NTIS CSCL 22B

CONTENTS:

1. MODULAR SPACEBORNE PROCESSORS W. R. Wadden, H. S. Zieper (RCA, Camden, N. J.), J. M. Gould, and R. Asquith p 3-26 (See N71-35053 21-31)

2. FAULT-TOLERANT COMPUTER DESIGN FOR SPACE SHUTTLE I. Goodman (GE, Utica, N. Y.) p 27-46 (See N71-35054 21-31)

3. CONFIGURATION ALTERNATIVES FOR DATA BUS SUBSYSTEM INTERFACE UNITS E. Chevers and W. Mellary p 47-70 (See N71-35055 21-31)

4. DATA BUS CONCEPTS FOR THE SPACE SHUTTLE J. R. Lane (GE, Daytona Beach, Fla.) p 71-86 (See N71-35056 21-31)

5. DATA BUS TO SERVICED EQUIPMENT AND SENSOR INTERFACE B. S. Yolken (TRW Systems, Redondo Beach, Calif.) p 87-110 (See N71-35057 21-31)

6. SELF-SEQUENCING DATA BUS TECHNIQUES FOR SPACE SHUTTLE R. H. Hardin (Martin Marietta Corp., Denver, Colo.) p 111-140 (See N71-35058 21-31)

7. SOFTWARE DEVELOPMENT AND VERIFICATION TECHNOLOGY H. Trauboth and B. Hodges p 141-178 ref (See N71-35059 21-31)

8. SYNCHRONOUS EXECUTIVE AND BUS CONTROL SOFTWARE FOR REDUNDANT DATA MANAGEMENT SYSTEMS T. E. Daly (TRW Systems, Redondo Beach, Calif.) p 179-190 (See N71-35060 21-31)

9. HAL, A COMPILER LANGUAGE FOR SHUTTLE F. H. Martin (Intermetrics, Inc.) p 191-220 (See N71-35061 21-31)

10. DESIGN OF CATHODE RAY TUBE FOR THE SPACE SHUTTLE C. F. Conron (United Aircraft Corp., Norwalk, Conn.) p 221-250 (See N71-35062 21-31)

11. ONBOARD DATA STORAGE FOR SPACECRAFT J. E. Holthaus and L. B. Gangewere (Westinghouse Elec. Corp., Baltimore, Md.) p 251-288 (See N71-35063 21-31)

12. MULTIPURPOSE DISPLAYS FOR SPACE SHUTTLE A. P. Yeager, Z. G. Tygielski, F. L. Holmes (IBM, Oswego, N.Y.) p 289-308 (See N71-35064 21-31)

13. SELF-TEST TECHNIQUES FOR REDUNDANT DATA MANAGEMENT SYSTEMS M. Kayton and H. S. E. Tsou (TRW Systems Group, Redondo Beach, Calif.) p 309-328 (See N71-35065 21-31)

14. UNIFIED TEST EQUIPMENT: A CONCEPT FOR THE SHUTTLE GROUND TEST SYSTEM E. A. Dalke (NASA, MSC, Houston, Tex.) p 329-354 (See N71-35066 21-31)

15. A STANDARD LANGUAGE FOR TEST AND GROUND OPERATIONS H. C. Paul p 355-358 (See N71-35067 21-31)

16. SOLID STATE SEQUENCER SYSTEM D. E. Leck (Martin Marietta Corp., Denver, Colo.) p 359-378 refs (See N71-35068 21-31)

N71-35053*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MODULAR SPACEBORNE PROCESSORS c08
W. R. Wadden (RCA, Camden, N. J.), H. S. Zieper (RCA, Camden, N. J.), J. M. Gould, and R. Asquith *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 3-26 Prepared jointly with RCA, Camden, N. J. Advanced Technol. Labs. (See N71-35052 21-31)
Avail: NTIS CSCL 22B

The development of data processing configurations for support of the next generation of space missions is discussed. A review of the large scale instrumentation technology, supportive design automation aids, and system level explorations are presented. A review of the technology base for a highly reliable baseline computer system is included. Author

N71-35054*# General Electric Co., Utica, N.Y.
FAULT-TOLERANT COMPUTER DESIGN FOR SPACE SHUTTLE c08
Irving Goodman *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 27-46 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

Redundancy techniques for designing highly reliable computer systems for use in Space Shuttles are described. A candidate architecture for evaluating the various techniques is presented. Emphasis is placed on practicality of the technique. The influence of flight critical areas on the requirement for increased computer system reliability is discussed. Author

N71-35055*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
CONFIGURATION ALTERNATIVES FOR DATA BUS SUBSYSTEM INTERFACE UNITS c08
Edward Chevers and William Mellary *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 47-70 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

The characteristics of a data bus system to acquire data from and distribute data and commands to space vehicle subsystems are presented. Three basic approaches to the solution of implementing the functions of the subsystem interface unit (SIU) are presented. Two configurations convert the digital data into analog voltages of discrete mode commands. The third system uses a sub-bus to distribute commands. Considerations necessary to effect a final design of a functional unit are discussed. Author

N71-35056*# General Electric Co., Daytona Beach, Fla.
DATA BUS CONCEPTS FOR THE SPACE SHUTTLE c08
John R. Lane *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 71-86 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

The advantages of using a data bus to facilitate the data handling process on Space Shuttles are discussed. The use of a data bus provides flexibility to accomodate design changes and system growth, facilitates organization of computer and subsystem interfaces, and has less wiring and complexity. Substantial weight savings are possible by using a data bus instead of hard wiring. Author

N71-35057*# TRW Systems, Redondo Beach, Calif.
DATA BUS TO SERVICED EQUIPMENT AND SENSOR INTERFACE c08
Berry S. Yolken *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 87-110 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

The development and application of the data bus technique for Space Shuttle data management systems is discussed. The interface between data bus terminals and the serviced equipment of the space shuttle is examined. Problems of ground discontinuities, asynchronous data transfer, analog conversion, data multiplexing, and sensor signal conditioning are investigated. Author

N71-35058*# Martin Marietta Corp., Denver, Colo.
SELF-SEQUENCING DATA BUS TECHNIQUES FOR SPACE SHUTTLE c08
Robert H. Hardin *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 111-140 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

The application of self-sequencing data bus techniques for space shuttle data management systems is discussed. Reliability, redundancy management, and flexibility of operation features are compared with those of the centralized control approach. Two other self-sequencing alternatives are presented. Author

N71-35059*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SOFTWARE DEVELOPMENT AND VERIFICATION TECHNOLOGY c08
H. Trauboth and B. Hodges *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 141-178 ref (See N71-35052 21-31)
Avail: NTIS CSCL 22B

Critical areas in software development which should receive more attention and be funded for further research are discussed. Conceptual solutions to the problems are presented. Procedures for the development and verification of complex software are described. Author

N71-35060*# TRW Systems, Redondo Beach, Calif.
SYNCHRONOUS EXECUTIVE AND BUS CONTROL SOFTWARE FOR REDUNDANT DATA MANAGEMENT SYSTEMS c08
T. E. Daly *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 179-190 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

The objectives, characteristics of approach, and method for achieving objectives in the development of executive software for the space shuttle are discussed. The synchronous executive divides time into repetitive cycles. In order to facilitate management of the software, software modules are permanently assigned to various cycles. Bus transmission intervals are assigned to corresponding time intervals. Author

N71-35061*# Intermetrics, Inc., Cambridge, Mass.
HAL, A COMPILER LANGUAGE FOR SHUTTLE c08
Fred H. Martin *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 191-220 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

The HAL Programming Language has been developed. HAL accomplishes three significant objectives: (1) increased readability, through the use of a natural two-dimensional mathematical format; (2) increased reliability, by providing for selective recognition of common data and subroutines, and by incorporating specific data-protect features; and (3) real-time control facility, by including a comprehensive set of real-time control commands and signal conditions. Although HAL is designed primarily for programming on-board computers, it is general enough to meet nearly all the needs in the production, verification and support of aerospace, and other real-time applications. Author

N71-35062*# United Aircraft Corp., Norwalk, Conn. Norden Div.
DESIGN OF CATHODE RAY TUBE DISPLAYS FOR THE SPACE SHUTTLE c09
G. F. Conron *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 221-250 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

The development of a display system for the Space Shuttle Vehicle is discussed. The design has been based on the systematic evaluation of display system technologies, adapted, as required, to the Space Shuttle display requirements. Several configurations have been compared on the basis of cost effectiveness. The use of the system for crew/computer communication is discussed. Author

N71-35063*# Westinghouse Electric Corp., Baltimore, Md. Defense and Space Center.
ONBOARD DATA STORAGE FOR SPACECRAFT c08
J. E. Holthaus and L. B. Gangewere *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf, Vol. 3 1971 p 251-288 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

A summary of a design study and laboratory program to evaluate and select a technique for presenting static manual/handbook data in the crew station of the Space Shuttle is presented. Bulk storage data will be required to be displayed on one or all three of the displays depending on the flight situation. Size, weight, power, and flexibility will determine the type of storage unit and video display system used. Author

N71-35064*# International Business Machines Corp., Oswego, N.Y. FSD Electronics System Center.
MULTIPURPOSE DISPLAYS FOR SPACE SHUTTLE c09
A. P. Yeager, Z. G. Tyglelski, and F. L. Holmes *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 289-308 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

A concept is described utilizing state-of-the-art technologies to form an integrated display system suitable for computer management and optimized for pilot acceptability. A capability is

provided to display on command/demand any one of several flight displays. As follows: (1) aero mode flight attitude, (2) space flight attitude, and (3) horizontal situation type displays. For flexibility and growth, a general graphic alphanumeric capability is provided to format such displays as engine parameters, subsystem summaries and detailed subsystem status displays. Author

N71-35065*# TRW Systems Group, Redondo Beach, Calif.
SELF-TEST TECHNIQUES FOR REDUNDANT DATA MANAGEMENT SYSTEMS c08
Myron Kayton and H. S. E. Tsou *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 309-328 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

A description of the space shuttle data management system is presented. The function of the data management system is to provide a data transmission and data processing service for the avionics equipment and for other vehicle subsystems. It performs all the on-board data processing except that assigned to special processors for engine control, and for analog stability augmentation. The system consists of quadruply-redundant data buses and computers, and associated equipment. An Input-Output Control Unit (IOCU) is dedicated to each computer. It can operate or monitor all four data buses under software control. It has direct access to a portion of the computer's memory. The System Control Unit (SCU) designates the computer-IOCU that is in control of the data bus and compares status information from redundant computers. Digital interface units (DIU) in each bay connect the line replaceable units (LRU) to the data bus. The DIU receives and transmits bus messages, multiplex and demultiplex data, performs the analog to digital conversion, applies excitation and stimuli to some of the sensors, and collects status information. Author

N71-35066*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
UNIFIED TEST EQUIPMENT: A CONCEPT FOR THE SHUTTLE GROUND TEST SYSTEM c11
Edgar A. Dalke *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 329-354 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

A unified test equipment (UTE) concept is described that has the characteristics required for a cost-effective ground support system through the reduction of hardware inventories and operational cost, and planned ground/onboard compatibility. Baseline test and support requirements and hardware flows have been developed that illustrate the feasibility of the UTE to meet overall Shuttle Program objectives. The design approach emphasizes modular building blocks for maximizing commonality to allow flexibility in efficient configuring of the hardware to satisfy early vendor/prime-contractor test requirements, as well as prelaunch and refurbishment support. The concept provides inherent compatibility to permit subsystem emulation as required to enhance the buildup and integration of vehicle subsystems, particularly during the R&D phases. Hardware elements that are described include the universal test console, the automatic RF test set, digital interface units for remote control and monitoring of GSE, and data bus interfaces. Author

N71-35067*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
A STANDARD LANGUAGE FOR TEST AND GROUND OPERATIONS c11
Henry C. Paul *In its* Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 2 1971 p 355-358 (See N71-35052 21-31)
Avail: NTIS CSCL 22B

The Space Shuttle characteristics of maximum onboard autonomy, two weeks turnaround capability, and a computer controlled data management system demand effective computer hardware and software for onboard operations as well as for launch checkout and preparations. It is proposed that a standard language for test and ground operations be specified and that this language be used for test procedure definition for all levels of space shuttle flight and ground support hardware from line replaceable units (LRU's) up. This language should be defined and documented adequately to allow its use at the outset of the Phase C/D Space Shuttle contract. The language specification shall contain syntax definitions with structure to facilitate computer implementation of all valid language statements. The choice of language primitive and sentence order shall be test engineer oriented, unambiguous, and as simple as possible. Author

N71-35068*# Martin Marietta Corp., Denver, Colo.
SOLID STATE SEQUENCER SYSTEM c09
David E. Leck *In* NASA. Manned Spacecraft Center Proc. of the Space Shuttle Integrated Electron. Conf., Vol. 3 1971 p 359-378 refs (See N71-35052 21-31)
Avail: NTIS CSCL 22B

The solid state sequencer system (S4) was designed to perform the functions of the present Apollo sequencers which are relay implemented. The S4 controls the EDS ABORT, SPS ABORT, CM-SM SEP, LM-SLA SEP and ELS sequences. However, because it is a stored program type system, it can be easily adapted to other applications requiring the same high reliability such as sequencing crew safety functions aboard the Space Shuttle. Author

N71-35069*# Dynamics Research Corp., Wilmington, Mass. Systems Div.
LIFTING-ROBOT-SPACE SHUTTLE PRELIMINARY MISSION PROFILE OPTIMIZATION PROGRAM. PART 1: MATHEMATICAL FORMULATION
Robert G. Gottlieb 29 May 1971 159 p refs
(Contract NAS8-25713)
(NASA-CR-119922; R-120U-Pt-1) Avail: NTIS CSCL 22B

The input for LIFTING ROBOT which is a minimum Hamiltonian-steepest ascent multistage lifting booster optimization program is described and an example problem is presented. Author

N71-35070*# Aerospace Corp., El Segundo, Calif. Systems Planning Div.
SPACE RESCUE OPERATIONS. VOLUME 1: MANAGEMENT SUMMARY REPORT
E. Perchonok 12 May 1971 26 p 3 Vol.
(Contract NASw-2078)
(NASA-CR-121719; ATR-71(7212-05)-1-Vol 1) Avail: NTIS CSCL 22A

An analysis of mission requirements and hardware utilization during possible space rescue operations is presented. Factors involving hardware design and development decisions, operational procedures, and safety, escape, and rescue interfaces between major hardware elements and remedial equipment are considered. Author

N71-35071*# Martin Marietta Corp., Denver, Colo.
SPACE SHUTTLE PROPULSION SYSTEMS ON-BOARD CHECKOUT AND MONITORING SYSTEM DEVELOPMENT STUDY. VOLUME 4: APPENDICES Final Report
Mar. 1971 457 p
(Contract NAS8-25619)
(NASA-CR-119839; MCR-71-62-Vol-4) Avail: NTIS CSCL 22B

Pertinent information resulting from the study is presented and includes: (1) nomenclature listings, (2) failure modes and effects analysis data sheets, (3) line replaceable units maintenance procedures summary, and (4) checkout and monitoring requirements analysis. For Vols. 1, 2, and 3, see N71-29521 thru N71-29523. D.L.G.

N71-35072*# Aerospace Corp., El Segundo, Calif. Systems Planning Div.
SPACE RESCUE OPERATIONS. VOLUME 2: TECHNICAL DISCUSSION
M. G. Hinton, Jr. 12 May 1971 158 p refs 3 Vol.
(Contract NASw-2078)
(NASA-CR-121869; ATR-71(7212-05)-1-Vol-2) Avail: NTIS CSCL 22A

The mission requirements and hardware aspects of rescue operations in space are discussed. Subjects presented are: (1) mission model and hardware definition, (2) hazards analysis, (3) contingency planning, (4) rescue vehicle requirements, (5) operational considerations, and (6) remedial system analysis. Author

N71-35073*# Aerospace Corp., El Segundo, Calif. Systems Planning Div.
SPACE RESCUE OPERATIONS. VOLUME 3: APPENDICES
E. J. Rattin 12 May 1971 470 p refs 3 Vol.
(Contract NASw-2078)
(NASA-CR-121868; ATR-71(7212-05)-1-Vol-3) Avail: NTIS CSCL 22A

An analysis of the various aspects of conducting rescue operations in space is presented. Detailed descriptions of the emergency requirements, human factors aspects, space vehicle utilization, and contingency planning are submitted for the information of specialists in the areas described. Author

N71-35074*# Boeing Co., Seattle, Wash. Aerospace Group.
ACTIVE CLEANING TECHNIQUE FOR REMOVING CONTAMINATION FROM OPTICAL SURFACES IN SPACE
Quarterly Progress Report, 1 May - 1 Aug. 1971
R. B. Gillette and W. D. Beverly Aug. 1971 32 p refs
(Contract NAS8-26385)
(NASA-CR-121763; QPR-2) Avail: NTIS CSCL 22B

Work accomplished during the second quarter is reported. This program is aimed at developing an active cleaning technique (ACT) for removing contaminants from optical surfaces in space. During this reporting period, preparation of test facilities and specimens was completed, a plasma generator design was developed for introducing a reactive gas into high vacuum, contaminant film deposition experiments were conducted, and plasma cleaning experiments were completed on several ultraviolet mirrors and a silvered Teflon thermal control surface. The plasma generator design minimizes the problem of atomic oxygen recombination on plasma tube walls, and thus introduces the possibility of piping the reactive gas to remote areas of a spacecraft. In contaminant film deposition experiments, hydrocarbon organic monomers evaluated were styrene, methane, and 1,3-butadiene. Butadiene produced the best results and thus was selected for subsequent experiments. In plasma cleaning experiments it was found that the hydrocarbon contaminant could be successfully removed from all surfaces without adverse effects. Author

N71-35075*# Boeing Co., Seattle, Wash. Aerospace Group.
ACTIVE CLEANING TECHNIQUE FOR REMOVING CONTAMINATION FROM OPTICAL SURFACES IN SPACE
Quarterly Progress Report, 1 Feb. - 1 May 1971
R. B. Gillette and W. D. Beverly May 1971 30 p refs
(Contract NAS8-26385)
(NASA-CR-119802; QPR-1) Avail: NTIS CSCL 22A

Progress is reported on design and preparation of test facilities, preparation of test specimens, experiments aimed at optimizing the design of the plasma cleaning device, and experiments aimed at establishing the design of a suitable device for depositing liquid contaminants on specimens in vacuum. Author

N71-35076*# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
AN ENGINEERING STUDY OF ONBOARD CHECKOUT TECHNIQUES. TASK 1: REQUIREMENTS ANALYSIS AND CONCEPTS Final Report
A. P. McKinley Mar. 1971 360 p
(Contract NAS8-11189)
(NASA-CR-115128; IBM-71W-00111) Avail: NTIS CSCL 22B

The results are presented of a program to identify requirements and develop concepts for a system to perform automated onboard failure detection, fault isolation, and recovery in a manned space station. Accomplishments reported include: (1) objectives and guidelines were analyzed to determine their impact on the onboard checkout system requirements; (2) subsystem and major component failure modes, failure effects, and failure rates were established; (3) line replaceable units were defined for each subsystem; (4) a strategy was developed for the integrated checkout of the space stations by defining the functions required to isolate a failure to a particular subsystem; (5) subsystems and integrated tests were defined to perform the checkout functions; and (6) functional and performance characteristics required for data management system to perform the onboard checkout task were defined. D.L.G.

N71-35077*# International Business Machines Corp., Huntsville, Ala. Federal Systems Div.
AN ENGINEERING STUDY OF ONBOARD CHECKOUT TECHNIQUES. TASK 2: SOFTWARE Final Report
D. M. Welsh Mar. 1971 516 p
(Contract NAS8-11189)
(NASA-CR-115129; IBM-71W-00112) Avail: NTIS CSCL 22B

The results are presented of a study to determine requirements for language and executive software to accomplish automated onboard checkout of a space station. A detailed description of the software study is given along with a summary of the analysis and recommendations derived from the study. An interpretive high level language and a multi-level executive were recommended to satisfy the checkout requirements. The specific elements defined for this language and the requirements of the multi-level executive are summarized. D.L.G.

N71-35078*# International Business Machines Corp., Huntsville, Ala. Electronics Systems Center.
AN ENGINEERING STUDY OF ONBOARD CHECKOUT TECHNIQUES. TASK 3: ONBOARD MAINTENANCE
R. P. Beck Mar. 1971 118 p refs
(Contract NAS8-11189)
(NASA-CR-115130; IBM-71W-00113) Avail: NTIS CSCL 22B

The results are presented of an investigation to generate recommendations for supporting research and technology activities leading to the implementation of a manned electronics maintenance facility for the space station. The accomplishments reported include: (1) establishment of a data base consisting of information about the electronic subsystems, their line replaceable units, and their shop replaceable assemblies; (2) identification of maintenance techniques (substitution, direct replacement, and testing fault location) and their applicability to different maintenance approaches; (3) analysis of maintenance incidents, or the frequency with which maintenance actions will be expected in each group of electronic equipment of interest; (4) analysis of average crew time requirements to support fault isolation and maintenance; (5) estimation of weight penalties associated with each maintenance concept; and (6) identification of tools and test equipment applicable to the onboard maintenance capability. D.L.G.

N71-35079*# International Business Machines Corp., Huntsville, Ala. Electronic Systems Center.
AN ENGINEERING STUDY OF ONBOARD CHECKOUT TECHNIQUES. TASK 5: SUBSYSTEM LEVEL FAILURE MODES AND EFFECTS
J. H. Frizzell Mar. 1971 19 p refs
(Contract NAS8-11189)
(NASA-CR-115131; IBM-71W-00115) Avail: NTIS CSCL 22B

A failure effects analysis was conducted on the guidance, navigation, and control, data management, and communications

subsystems. This analysis, coupled with other results, indicated that no failure modes exist which invalidate the onboard checkout concepts. A.L.

N71-35080*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ROTARY ACTUATOR Patent Application
Allan R. Mc Dougal, inventor (to NASA) and Richard L. Moore, inventor (to NASA) Filed 5 Jan. 1971 43 p
(Contract NAS7-100)
(NASA-Case-NPO-10680; US-Patent-Appl-SN-104048) Avail: NTIS CSCL 22B

A rotary actuator is described for use aboard operative spacecraft for deploying pivotally supported structures such as, for example, solar panels and the like. The actuator is characterized by a torsion bar coupled with a pivotally supported crank arm through a gear cluster in a manner such that the torsion bar continuously applies a constant deployment force to the solar panel. When the solar panel is in a retracted configuration, it serves to deploy the panel at a controlled, sinusoidal rate of acceleration, and subsequently supports the panel in its deployed configuration with minimal supporting forces being applied to the panel through a maximum moment arm whereby structural rigidity for the deployed panel is achieved. NASA

N71-35081*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
METHOD AND SYSTEM FOR EJECTING FAIRING SECTIONS FROM A ROCKET VEHICLE Patent Application
Lawrence F. Hatakeyama, inventor (to NASA) Filed 1 Apr. 1971 26 p
(NASA-Case-GSC-10590-1; US-Patent-Appl-SN-130353) Avail: NTIS CSCL 22B

A system for deploying releasable clam-shell fairing sections from a spinning rocket vehicle body is described. Each fairing section is retained at its lower trailing edge portion, relative to the spin direction of the rocket, until it has been substantially despun and rotated outwardly from the rocket through a predetermined angle to eliminate the possibility of the fairing sections striking the vehicle payload. A separable hinge unit is utilized connecting the lower trailing corner portion of each fairing section to the rocket vehicle body. This portion will be the last to separate from the vehicle body and will be retained until the fairing section has rotated outwardly through the desired angle. Author

N71-35082*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
DOCKING STRUCTURE FOR SPACECRAFT Patent Application
Robert R. Below, inventor (to NASA) Filed 6 Jul. 1971 15 p
(NASA-Case-MFS-20863; US-Patent-Appl-SN-159966) Avail: NTIS CSCL 22B

A docking structure for a pair of spacecraft is described which is comprised of a conical receptacle on the docking end of a first spacecraft that receives a mating conical projection on the docking end of the second spacecraft. The conical receptacle of the first spacecraft constitutes an exterior portion of a sealed gas-tight compartment. Pressurization of the sealed compartment causes the conical receptacle to extend toward the incoming conical receptacle to extend toward the incoming conical projection of the second spacecraft and when the mating conical portions are latched together, the docking energy is absorbed by the compressed gas in the sealed compartment. Rebound forces are countered by a plurality of actuator cylinders supporting the conical receptacle. NASA

N71-35083*# Martin Marietta Corp., Denver, Colo.
LOW-COST ABLATIVE HEAT SHIELDS FOR SPACE SHUTTLES Final Report
Hust H. Chandler Oct. 1970 87 p
(Contract NAS1-9946)
(NASA-CR-111800) Avail: NTIS CSCL 22B

Results are presented of a study performed to determine the cost of fabricating replaceable ablative heat shield panels. Curved and flat, 2x4 panels were fabricated from four ablative compositions using processes developed under this study. Time studies were conducted to estimate the cost of fabricating panels of various configurations and lot sizes, based on one, 10, and 100 flights. Panel costs varied from a high of $296.66 per square foot for a double-contoured, 2x4 panel made of 67% silicone resin and 33% phenolic Microballoons to a low of $48.96 per square foot for 4x8 panels composed of 90% Microballoons and 10% silicone resin. The cumulative average cost for a space shuttle vehicle using all nylon-phenolic or all elastomeric ablative panels is given along with a cost breakdown for low density, 2x4 foot, flat, elastomeric ablative panels. Author

N71-35084*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: EFFECTS OF HORIZONTAL TAIL GEOMETRY AND POSITION ON LONGITUDINAL STABILITY OF MODEL S-5, NASA/MSC 0.01875 SPACE ORBITER SHUTTLE
H. A. Pope Mar. 1971 162 p
(Contract NAS8-4016)
(NASA-CR-119858; DMS-DR-1073) Avail: NTIS CSCL 22B

A 0.01875 scale model (model S-5) of a preliminary version of the NASA/MSC orbiter shuttle configuration was tested in the low speed wind tunnel to obtain data to show the effects of horizontal tail geometry and vertical position on the longitudinal characteristics of the orbiter configuration. These tests were conducted at a Mach number of 0.25 at a Reynolds number of 1.7 million per foot. The model was tested at an angle of attack range of -6 to 10 deg at zero sideslip angle. Horizontal tail aspect ratio, area, leading edge sweep, tail incidence angle, and vertical position were tested. Author

N71-35085*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: AERODYNAMIC FORCES AND MOMENT ON ORBITER AND BOOSTER DURING SPACE SHUTTLE ABORT SEPARATION
J. M. De Bevoise Mar. 1971 656 p
(Contract NAS8-4016)
(NASA-CR-103197; DMS-DR-1052) Avail: NTIS CSCL 22B

Aerodynamic interference between booster and orbiter under conditions representing early (abort) separation was investigated in the Convair 4 ft x 4 ft high speed wind tunnel. The 0.0035 scale models represented the North American Rockwell orbiter configuration 130G (straight wing) and 134B (delta wing), and the General Dynamics/Convair booster configuration 88X (straight wing) and 89J (delta wing). The Mach numbers were 1.1 and 1.6 The orbiter and booster models were mounted on individual six-component force balances. The orbiter was mounted on a fixed support, while the booster, mounted on the captive trajectory rig, traversed the flow field of the orbiter at various separation distances. All runs were at zero yaw and roll with zero relative lateral displacement, so only pitch-plane data are reported. The orbiter angles of attack were from +5 to -10 deg. The booster angles of attack were from +5 deg to -15 deg. Author

N71-35086*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: LOW SPEED AERODYNAMIC CHARACTERISTICS OF THE MCDONNELL DOUGLAS SPACE SHUTTLE BOOSTER, DOUGLAS LONG BEACH, LOW SPEED, WIND TUNNEL TEST RESULTS
C. M. Finch Dec. 1970 125 p
(Contract NAS8-4016)
(NASA-CR-103161; DMS-DR-1035; DRL-184-58) Avail: NTIS CSCL 22B

A one-percent scale model of the McDonnell Douglas Corporation space shuttle booster was tested in the Long Beach low speed wind tunnel. Tests were conducted at a Mach number

of 0.18 and dynamic pressure of 50 psf over an angle of attack range from -6 to 16 at fixed sideslip angles of 0 deg. and -6 deg. The test configurations were varied so an evaluation of the interference effects of the power off jet flap on a high and low wing could be made. Similarly tests were conducted to evaluate the interference effects of a mid-wing aero canard on a high wing and low wing configuration. Author

N71-35067*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: LONGITUDINAL AERODYNAMIC CHARACTERISTICS OF THE GD/CONVAIR 88B BOOSTER. WIND TUNNEL TEST RESULTS
W. V. Carter and M. J. Lafranco Oct. 1970 254 p
(Contract NAS8-4016)
(NASA-CR-103158; DMS-DR-1025; DRL-184-58) Avail: NTIS CSCL 22B

A 0.0035 model scale of the General Dynamics/Convair Space Shuttle 88B Booster was tested in the Convair 4 ft x 4 ft high speed wind tunnel during July 1970 to determine the longitudinal aerodynamic characteristics of the booster over a Mach range of 0.90 to 4.60. A six component force and moment internal balance was utilized and the configurations tested consisted of: a basic body with different nose and afterbody shapes; a straight wing and a delta wing; and different tail assemblies with control deflection capabilities. The models were pitched over an angle of attack range of -1 deg to 62 deg at fixed sideslip angles of 0 deg and -5 deg. The Reynolds number range for this test was 7,800,000 to 17,500,000/foot. The data required during this test were force and moment data, base and balance cavity pressure data, tunnel conditions, Schlieren photographs and movies, and buffet data. Author

N71-35068*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: AEDC VON KARMAN TUNNEL C, TEST VT0055 SAMSO-GD/CONVAIR T-18 HYPERSONIC STATIC STABILITY AND CONTROL EFFECTIVENESS INVESTIGATION. WIND TUNNEL TEST RESULTS
W. H. Gallaher and C. J. Spurlin Jul. 1970 61 p
(Contract NAS8-4016)
(NASA-CR-103151; DMS-DR-1006; DRL-184-58) Avail: NTIS CSCL 22B

Results are presented of an experimental wind tunnel investigation on the SAMSO-GD/Convair T-18 variable geometry configuration of the Space Transportation System study. Tests of this configuration were conducted in the AEDC von Karman Facility, Tunnel C hypersonic wind tunnel. The nominal free stream tunnel conditions during the test were a Mach number =10.0, a Reynolds number = 1 million per foot and a free stream dynamic pressure of 1.2 psia. Parameters investigated included: (1) static longitudinal stability over a range of angles of attack from 8 degrees to 55 degrees; (2) static directional stability over a range of sideslip angle from -8 degrees to 8 degrees; (3) control effectiveness using elevon deflections ranging from -20 degrees to 20 degrees and rudder/vator deflections ranging from -20 degrees to 40 degrees. Author

N71-35069*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: LONGITUDINAL AND LATERAL AERODYNAMIC CHARACTERISTICS OF THE CONVAIR 88B SPACE SHUTTLE BOOSTER WITH MODIFICATIONS
H. Robinson, W. Gallaher, and R. Culp Nov. 1970 144 p
(Contract NAS8-4016)
(NASA-CR-103159; DMS-DR-1029) Avail: NTIS CSCL 22B

Results are presented of an experimental wind tunnel investigation of the Convair 88B space shuttle booster and configuration perturbations. The model configuration perturbations consist of different body lengths, a straight wing in each of three longitudinal locations, a delta wing in one longitudinal location with and without cruise engine simulation. A Vee-tail and two horizontal-vertical tail arrangement were investigated in conjunction with the straight wing. The plotted axial force data presented has not been corrected for balance cavity pressure. The magnitude of this correction was negligible and the apparent magnitude of the balance cavity correction was considerably less than the accuracy of the measurement. The coefficients dependent on the axial force coefficient incorporate this uncorrected value. Stability and control effectiveness data, the effects of the various model geometric perturbations, and configuration build-up data have been presented in this report. This test was conducted in the General Dynamics hypersonic wind tunnel. The nominal tunnel free stream conditions during this test was Mach number of 8.05, Reynolds number of 1,900,000/foot, and a dynamic pressure of 2 psi. The angle of attack range was 0 to 57 degrees. Author

N71-35090*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STATIC STABILITY AND CONTROL INVESTIGATION OF THE NAR-GDVC STRAIGHT WING BOOSTER (S-3H MODIFIED) WITH THE STRAIGHT WING ORBITER (130G) OR DELTA WING ORBITER (134B)
E. C. Allen, J. F. Hardesty, and F. M. Eder Feb. 1971 989 p
(Contract NAS8-4016)
(NASA-CR-103196) Avail: NTIS HC (individually priced)/MF $0.95 CSCL 22B

Experimental aerodynamic investigations were conducted at the MSFC 14 x 14 inch trisonic wind tunnel on the North American Rockwell/General Dynamic space shuttle system to determine the vehicle's static stability and controllability. The tests utilized the GD straight wing booster, tested alone and with either the NAR straight or delta wing orbiter and covered a Mach number range from 0.6 to 4.96. Vehicle orientation was varied over an angle of attack range from -10 deg to 10 deg at a constant sideslip angle of 0 deg, and over a sideslip range of -4 deg to 10 deg at constant angles of attack of 0, -6, +6 deg. Control deflections were restricted to the booster and included horizontal tail deflections of 0, -10, and -20 deg, a horizontal tail differential deflection of 20 deg and a rudder deflection of 0 and 6.5 deg. Author

N71-35091*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: LONGITUDINAL AND LATERAL STABILITY CHARACTERISTICS OF THE MDC STS HIGH CROSS RANGE ORBITER (02)
R. E. Cole, M. V. Heckart, and D. Field Dec. 1970 266 p
(Contract NAS8-74016)
(NASA-CR-103163; DMS-DR-1040; DRL-184-58) Avail: NTIS CSCL 22B

The test of the MDC 4% scale model of the high cross range shuttle orbiter was conducted at the McDonnell Douglas low speed wind tunnel. This test was conducted to describe the basic longitudinal, lateral, and directional stability aerodynamic characteristics for an angle of attack range from -10 to +20 degrees with sideslip angles of -3, 0, 3 and 6 degrees. Control surface effectiveness was obtained for eleven deflections of -15 and -30 degrees and rudder deflection combinations from -25 to +20 degrees. Tunnel conditions for the test were at dynamic pressures of 40, 90 and 100 psf and Reynolds numbers per foot of 1.2, 1.6 and 1.7 million, respectively. Author

N71-35092*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: EFFECTS OF ORBITER BOOSTER PROXIMITY INTERFERENCE ON THE AERODYNAMIC CHARACTERISTICS OF THE 0.0068106 SCALE MSC LAUNCH CONFIGURATION, MSC TEST SERIES S-2B
Feb. 1971 333 p
(Contract NAS8-4016)
(NASA-CR-119854; DMS-DR-1058; DRL-184-58) Avail: NTIS CSCL 22B

The supersonic phase of the 0.0068106-scale MSC orbiter booster separation test (MSC test series S-2B) was conducted in the LTV 4-foot High speed Wind Tunnel at Mach numbers of 1.81, 2.99, and 4.39. The purpose of this test was to define the effects of the orbiter booster proximity interference on the aerodynamic characteristics of the launch configuration during separation or abort maneuvers. Each model had both straight and delta wings available for variation of launch vehicle configuration

concepts, but only the strieght wing orbiter was utilized with both the straight and delta wing booster during this test. Author

N71-35093*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF SUBSONIC AERODYNAMIC CHARACTERISTICS OF THE NAR 134B DELTA WING ORBITER
Robert Mennell Dec. 1970 117 p
(Contract NAS8-4016)
(NASA-CR-103193; DMS-DR-1037) Avail: NTIS CSCL 22B

Low speed longitudinal, directional, and lateral static stability characteristics of the North American Rockwell delta wing orbiter (Model 134B) were determined at a Mach number of 0.26 and a Reynolds number of 1,850,000/ft. in the NAAL 7.75 x 11 foot low speed wind tunnel. The 0.00763 scale model basic body configuration was tested with several delta wings and vertical tail configurations. These configurations were tested at an angle of attack range of -4 to 45 deg at fixed sideslip angles and 0, 3, 5, and 6 deg and at a sideslip angle range of -8 to 8 deg at fixed pitch angles of 0, 12, 21, and 30 deg. Tests at rudder deflections of -10 and -20 deg and sting offset angles of 0, 15 and 45 deg were also conducted. Author

N71-35094*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: MDAC/MMC SPACE SHUTTLE BOOSTER DETERMINATION OF STABILITY AND CONTROL CHARACTERISTICS AND POWER EFFECTS AT SUBSONIC SPEED, MACH NUMBERS ZERO AND 0.26
D. Michna (Martin Marietta Corp., Baltimore, Md.), E. Lays (Martin Marietta Corp., Baltimore, Md.), C. Finch, and R. Roensch Mar. 1971 1010 p
(Contract NAS8-4016)
(NASA-CR-119861; DMS-DR-1077; DRL-184-58) Avail: NTIS CSCL 22B

An 0.03 scale model of the MDAC/MMC space shuttle booster was tested in the MCAIR low speed wind tunnel to determine the stability and control characteristics and power effects at subsonic speed. The tests were conducted at Mach numbers of 0.26 and zero, Reynolds number of 1.78 million per foot, and a dynamic pressure of 0.695 psi. Test variables included, canard configurations and location, canard jet flap deflection, engine jet pressure ratio, configuration buildup, and eleven deflections. This report contains plots of force and moment coefficient data only. Body base pressure coefficients for Mach 0.26 were recorded and have been input to the SADSAC data file but have not been displayed. Author

N71-35095*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: MODEL S-5 NASA/MSC ORBITER SHUTTLE INVESTIGATION OF THE EFFECTS OF VERTICAL TAIL AND GEOMETRY ON DIRECTIONAL STABILITY
David L. Eichblatt Feb. 1971 117 p
(Contract NAS8-4016)
(NASA-CR-119856; DMS-DR-1062) Avail: NTIS CSCL 22B

A 0.01875 scale model (model S-5) of a preliminary version of the NASA/MSC orbiter shuttle configuration was tested in the Texas A&M University low speed wind tunnel. The test was to determine the effects of changes in the aspect ratio, leading and trailing edge sweep angles, and area of the vertical tail on the directional stability of the vehicle. Forty-one vertical tails were used in this test program. The data are reduced about the center of gravity located at .60 of the body length. This test was conducted at a Mach number of 0.25 and a Reynolds number of 1.7 million per foot. The model was basically tested at an angle of attack of 2 degrees over a sideslip range of 0 to 10 degrees. Some angle of attack excursions and sideslip sweeps from -10 to 10 degrees were made in the preliminary stages of testing. Author

N71-35096*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: AERODYNAMIC CHARACTERISTICS OF THE NASA-MSC S-4 ORBITER IN CRUISE AND LANDING
E. B. Chambliss, R. H. Moore, and D. Millikan Mar. 1971 98 p
(Contract NAS8-4016)
(NASA-CR-119855; DMS-DR-1060) Avail: NTIS CSCL 22B

A 5.0 percent scale model of the NASA/MSC August 1969 baseline orbiter (Model S-4) was tested in the low speed wind tunnel to define the cruise and landing aerodynamic characteristics. These tests were conducted at a Mach number of 0.25, Reynolds number of 1.7 million per foot, and dynamic pressure of 70 psf. Variables applicable to this test were component buildup, horizontal tail incidence angle, elevator deflection, rudder deflection, flap configuration and deflection, spoiler configuration, and landing gear deployment. Author

N71-35097*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: DETERMINATION OF SUBSONIC AERODYNAMIC CHARACTERISTICS FOR MCDONNELL-DOUGLAS GENERIC HIGH CROSS RANGE SHUTTLE ORBITER
L. S. White Mar. 1971 316 p
(Contract NAS8-4016)
(NASA-CR-119859; DMS-DR-1074) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

A 1-1/3% scale generic high cross range shuttle orbiter wind tunnel test was conducted in the low speed wind tunnel in Long Beach, California. The test objective was to provide subsonic aerodynamic data for a number of body shapes, wing planforms, wing airfoil sections, and vertical tail geometry to aid in the selection of an improved design. In addition, elevon effectiveness and leading edge fillet effects were obtained on one configuration. Nominal tunnel conditions were at a dynamic pressure of 50 lb/sq ft, Mach number .18, and Reynolds number of approximately 1.2 million per foot. Transition strips consisting of 0.0065 inch thick tape cut with pinking shears were placed on the body approximately 1-1/2 inch aft of the nose. Similar strips were placed on the wings and vertical tail surfaces at approximately 6-10% chord. Author

N71-35098*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF LATERAL AND LONGITUDINAL STATIC STABILITY CHARACTERISTICS OF THE MSC ORBITERS S-1 AND S-5 AT MACH NUMBERS 0.25
Jan. 1971 274 p
(Contract NAS8-4016)
(NASA-CR-119853; DMS-DR-105; DRL-184-58) Avail: NTIS CSCL 22B

The MSC Orbiters S-1(0.02 scale) and S-5 (0.01875 scale) were tested in the Low Speed Wind Tunnel to determine the lateral and longitudinal static stability characteristics at a Mach number of 0.25, Reynolds number of 1.7 million per foot, and dynamic pressure of 0.632 psi. Test variables applicable to three tests were component buildup, horizontal tail incidence angles, wing location, and elevator deflections. Author

N71-35099*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: SUBSONIC AERODYNAMIC CHARACTERISTICS OF THE GAC ORBITER
W. Jung (Grumman Aerospace Corp.), M. Fracinella (Grumman Aerospace Corp.), and M. Quan (Grumman Aerospace Corp.) Apr. 1971 143 p
(Contract NAS8-4016)
(NASA-CR-119862; DMS-DR-1081; DRL-184-58) Avail: NTIS CSCL 22B

Two 0.04 scale models of the space shuttle orbiter were tested in the low speed wind tunnel. The models, a wide body and narrow body orbiter, were investigated to obtain the subsonic aerodynamic characteristics of each. Investigations were conducted for body alone, body-wing, body-vertical tail and body-wing-vertical tail configurations. For the complete model configurations, selected aileron, elevon and rudder control surface deflections were investigated. The models were pitched over an angle of attack range from -4 to 24 deg at fixed sideslip

angles of 0 and 3 deg, yawed over a range of -15 to 15 deg at fixed angles of attack approximately 0 and 21. The nominal test conditions were a Mach number of 0.17, a Reynolds number of 1.6 million per foot, and a dynamic pressure of 0.278 psi.
Author

N71-35100*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STATIC STABILITY AND CONTROL INVESTIGATION OF THE NAR DELTA WING (134D) AND STRAIGHT WING (130G) SPACE SHUTTLE ORBITERS
E. C. Allen (North American Rockwell Corp., Los Angeles Calif.) Mar. 1971 662 p
(Contract NAS8-4016)
(NASA-CR-119860; DMS-DR-1076; DRL-184-58) Avail: NTIS CSCL 22B

Experimental aerodynamic investigations were made on 0.0035 scale models of the Delta Wing (134d) and strieght wing (130G) space shuttle orbiters in the MFSC 14 inch trisonic wind tunnel. Tests were conducted over a Mach number range from 0.6 to 4.96 at Reynolds numbers from 4.4 to 8.9 million per unit length. The test primary objectives were control evaluations, therefore the strieght wing horizontal tail was deflected symmetrically over a range from -50deg to 30deg and unsymmetrically (aileron control about some elevator setting) at selected positions. Additionally the straight wing horizontal tail was set at zero incidence and symmetrical elevator deflections were tested over the same -50deg to 30deg range. These conditions were evaluated at 0deg sideslip angle over an angle of attack range from 40deg to 80deg. The delta wing orbiter control surfaces were evaluated over an angle of attack range from 0deg to 60deg at zero degrees sideslip and over an angle of sideslip range from -4deg to 10deg at angles of attack of 0deg, 15deg, 30deg, and 45deg. Author

N71-35101*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: DETERMINATION OF STATIC LONGITUDINAL AND LATERAL DIRECTIONAL STABILITY CHARACTERISTICS OF THE NR/GD DELTA WING ORBITER/SATURN 5 S-IC BOOSTER
Craig H. Muhlhauser Feb. 1971 277 p
(Contract NAS8-4016)
(NASA-CR-103200; DMS-DR-1055) Avail: NTIS CSCL 22B

Experimental aerodynamic investigations have been made in the Marshall Space Flight Center 14 x 14 inch trisonic Wind Tunnel on a North American Rockwell Corporation delta wing orbiter mated to a Saturn 5 S-1C booster for the primary purpose of determining the optimum incidence angle of the orbiter relative to the booster. Tests covered a Mach number range from 0.60 to 1.96 over an angle of attack schedule from -12 deg to 12 deg at zero degrees sideslip and a sideslip schedule from -1.5 deg to 18 deg at zero degrees angle of attack. Orbiter incidence angles tested were -2 deg, +1 deg, and +4 deg. Author

N71-35102*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: MMC PHASE A SPACE SHUTTLE MODIFIED ORBITER: INVESTIGATION OF STABILITY CHARACTERISTICS AND CONTROL EFFECTIVENESS
Dale Server (Martin Marietta Corp., Denver, Colo.) Jul. 1970 204 p
(Contract NAS8-4016)
(NASA-CR-103152; DMS-DR-1003) Avail: NTIS CSCL 22B

A 0.0038 scale model of the space shuttle modified orbiter was tested in the NASA MSFC 14-inch trisonic wind tunnel. This force and moment test was conducted to determine the effect of increased camber on the orbiter stability characteristics. The model was tested at a Mach number range of 0.4 to 4.95 at pitch angles of -4 deg to 25 deg and at zero sideslip. The model was tested with the elevons and rudders off, at elevon deflections of 0, -15 deg, and -30 deg, and at zero rudder deflections. Author

N71-35103*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: GAC 3 A CONFIGURATION, EARTH ORBITING SHUTTLE: EVALUATION OF LOW SPEED AERODYNAMIC CHARACTERISTICS
S. Kalemeris (Grumman Aircraft Corp.), A. McBride (Grumman Aircraft Corp.), and J. Wheeler (Grumman Aircraft Corp.) Jul. 1970 52 p
(Contract NAS8-4016)
(NASA-CR-103153; DMS-DR-1005; DRL-184-58) Avail: NTIS CSCL 22B

The test conducted in the GAC 7 x 10 foot low speed wind tunnel was designed to evaluate the low speed aerodynamic characteristics of the GAC A configuration earth orbiting shuttle and to determine whether a retractable wing would be required to provide sufficient lift for subsonic flight. The variables investigated were lower fuselage body flaps or speed brakes, different dihedral angles on the basic V tail, modifications to the tail and the fuselage near the tail. The wing was tested clean and with double slotted Fowler flaps deflected 45 and 55 degrees. Canards, camber changes on the lower fuselage, and upper fuselage surface spoilers were evaluated as possible means of trimming the high negative pitching moment without producing the loss in lift and increase in drag that would result from negative elevator deflection. Other variables investigated included the engines required for flight after reentry in the extended position and at various incidence angles, removable rocket nozzles, a cargo module on the upper fuselage surface to simulate a smaller shuttle with an external payload, and aft fuselage contour changes to reduce base drag. Base pressure measurements were recorded, and a 45 probe rake was used to measure pressure recovery behind the main model support.
Author

N71-35104*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF AERODYNAMIC CHARACTERISTICS OF THE GAC 51B EARTH ORBITING SHUTTLE, CONFIGURATION 11F, AT MACH NUMBER EQUALS .170
S. Kalemeris (Grummnh Aircraft Corp.), A. McBride (Grumman Aircraft Corp.), and J. Wheeler (Grumman Aircraft Corp.) Jan. 1971 72 p refs
(Contract NAS8-4016)
(NASA-CR-103198; DMS-DR-1053; DRL-184-58) Avail: NTIS CSCL 22B

These tests were designed to provide basic subsonic aerodynamic information on the GAC 2F configuration earth orbiting shuttle. Various lower fuselage camber lines and chine radii were tested in an attempt to increase the body lift without introducing a significant loss in longitudinal or lateral-directional stability. The wind was moved 200 inches aft in order to provide greater longitudinal stability. Several wing modifications were made to try and increase the stall angle of the wing and delay the subsequent pitch up. A simple hinge flap and a split flap were tested to investigate the high lift characteristics of the model. Also, a canard was tested to provide greater lift and to provide a longitudinal trim surface having a small drag penalty. In addition, base pressure measurements were taken and several aft fuselage modifications were made to reduce base drag.
Author

N71-35105*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: M/DAC DELTA WING BOOSTER: DETERMINATION OF LOW SPEED DIRECTIONAL STABILITY CHARACTERISTICS
C. M. Finch (McDonnell-Douglas Co., Long Beach, Calif.) Oct. 1970 74 p
(Contract NAS8-4016)
(NASA-CR-103157; DMS-DR-1014; DRL-184-58) Avail: NTIS CSCL 22B

Low speed wind tunnel tests have been conducted on the McDonnell-Douglas Corporation delta-wing booster to determine directional stability characteristics. The investigations were conducted in the Douglas-Long Beach low speed wind tunnel. A 1% scale model of the booster configuration was used. Test

results are included and consist of plotted coefficient data and sketches of flow field studies. Alpha and beta was varied between 16 degrees. No data were obtained with control surfaces deflected. Author

N71-35106*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF STATIC AERODYNAMIC CHARACTERISTICS OF THE MSC 251 BOOSTER
Robert H. Moore (NASA. Manned Spacecraft Center) Nov. 1970 403 p
(Contract NAS8-4016)
(NASA-CR-103164; DMS-DR-1033; DRL-184-58) Avail: NTIS CSCL 22B

A 0.0132 scale model of the MSC Booster 251 configuration (Model SB-15) was tested in a low speed wind tunnel to determine the static longitudinal and lateral characteristics, elevator effectiveness, and the effect of wing location, tail location, and tail incidence. Three Vee tails were also tested on the model. All testing was conducted at a Mach number of 0.25, Reynolds number of 1,700,000 per foot, dynamic pressure of 0632 psi, and stagnation temperature of 100 F. Author

N71-35107*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: EFFECT OF NACELLE POSITION, REFAIRED FUSELAGE, AND ELEVATOR EFFECTIVENESS AT MACH NUMBER 0.26 FOR THE NORTH AMERICAN ROCKWELL STRAIGHT WING ORBITER (0.00716 SCALE)
A. Tweedie, T. Tuddle, and W. Lester Nov. 1970 478 p
(Contract NAS8-4016)
(NASA-CR-103160; DMS-DR-1034; DRL-184-58) Avail: NTIS CSCL 22B

A 0.00761 scale model of the North American Rockwell Corporation (NAR) straight wing orbiter was tested in the NAR low speed wind tunnel to determine elevator effectiveness and the effect of nacelle position and a refaired fuselage. The model was tested at a Mach number of 0.26, Reynolds number of 1,850,000/foot, and dynamic pressure of 100 psf. Author

N71-35108*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF LONGITUDINAL, LATERAL AND DIRECTIONAL STABILITY CHARACTERISTICS FOR MODEL S-5, NASA/MSC ORBITER SHUTTLE
Aug. 1970 111 p
(Contract NAS8-4016)
(NASA-CR-103155; DMS-DR-1008; DRL-184-58) Avail: NTIS CSCL 22B

A 0.01875 scale model (model S-5) of a preliminary version of the NASA/MSC orbiter shuttle configuration was tested in the Texas A&M University low speed wind tunnel. The primary test objective was to obtain data describing the longitudinal, lateral, and directional stability characteristics of the orbiter configuration. These tests were conducted at a Mach number of 0.25 at a Reynolds number of 1,700,000 per foot. The model was tested at an angle of attack range of -8 to 16 deg at fixed sideslip angles of -10, -6, -4, -2, 0, 2, 4, 6, 10, 20, deg and with the elevator off; and at horizontal tail incidence angles of -5.2, 0, and 6 degs. Author

N71-35109*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: LONGITUDINAL AND LATERAL DIRECTIONAL STABILITY CHARACTERISTICS OF THE MDAC HIGH CROSS RANGE DELTA WING ORBITER
P. J. Seeny, D. Field, and D. Heinsmann Feb. 1971 416 p
(Contract NAS8-4016)
(NASA-CR-119857; DMS-DR-1067; DRL-184-58) Avail: NTIS CSCL 22B

This test was conducted to substantiate the high crossrange delta wing orbiter configuration by providing experimental verification of the estimated aerodynamic stability and control characteristics. The test article was a 4% scale model of the orbiter. The test was performed in the MCAIR low speed wind tunnel. Test variables included configuration buildup, rudder deflections, elevon/aileron deflections, cruise and landing configuration, with and without simulated engine pods. Nominal test conditions were Mach number 0.26, dynamic pressure of 100 psf, and Reynolds number of 1.6 million per foot. Author

N71-35110*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: EFFECT OF CRUISE ENGINE NACELLE ARRANGEMENT AND TAIL SIZE ON STATIC STABILITY AND CONTROL EFFECTIVENESS
Z. Zombek, W. Goldberg, and J. Rausch Dec. 1970 433 p
(Contract NAS8-4016)
(NASA-CR-103162; DMS-DR-1039; DRL-184-58) Avail: NTIS CSCL 22B

Results of a low speed experimental wind tunnel investigation of a straight wing and a delta wing configuration space shuttle booster model are presented. The test was conducted in the General Dynamics/Convair low speed wind tunnel. Tests were conducted at dynamic pressures of 50 lb/sq ft and 100 lb/sq ft. Parameters investigated using the straight wing configuration included horizontal and vertical tail size, control effectiveness, body nose shape, and type of engine installation. Parameters investigated using the delta wing configuration included effects of straight wing cruise engine nacelles, and effect of canards. Author

N71-35111*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF LOW SPEED AERODYNAMIC CHARACTERISTICS OF A HIGH CROSSRANGE MDC STS ORBITER
D. Fields, M. V. Heckart, and P. J. Seeney Jan. 1971 103 p
(Contract NAS8-4016)
(NASA-CR-103194; DMS-DR-1041; DRL-184-58) Avail: NTIS CSCL 22B

This test was undertaken to define the low speed longitudinal and lateral aerodynamic characteristics of the MDAC Double Delta (HCR) orbiter shuttle. The 4.0 percent scale model Double Delta Orbiter was tested in the McDonnell Aircraft Company low speed wind tunnel. The configurations were tested over an angle of attack range from -10 deg to +20 deg and a sideslip angle range from -6 deg to +3 deg. Nominal test conditions were at a dynamic pressure of 90 psf with a Mach number of 0.25 and Reynolds number of 1.6 million per foot. Author

N71-35112*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: MSC ORBITER (S-5) (AUGUST 1969 CONFIGURATION): LONGITUDINAL AND LATERAL STABILITY INVESTIGATION
A. M. Whitnah Aug. 1970 337 p
(Contract NAS8-4016)
(NASA-CR-103154; DMS-DR-1007) Avail: NTIS CSCL 22B

Information for wind tunnel force and moment test on a 0.01875 scale, (S-5) model of the MSC orbital shuttle is presented. Data describing the longitudinal and lateral stability characteristics of the MSC orbiter configuration for an angle of attack range from -30 deg to 90 deg and a sideslip angle range from -10 deg to 10 deg are presented. Data were also collected for two possible wing positions and for several horizontal stabilizers. Elevator power was determined for control during subsonic cruise. These data were collected at Mach numbers 0.16 and 0.25. Author

N71-35113*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: IRLV STRAIGHT WING ORBITER (MODEL 130C) LONGITUDINAL AND LATERAL STATIC STABILITY CHARACTERISTICS DURING CONFIGURATION BUILD-UP; HORIZONTAL TAIL CONTROL EFFECTIVENESS. WIND TUNNEL TEST RESULTS
Robert Mennell Aug. 1970 241 p
(Contract NAS8-4016)

(NASA-CR-103158; DMS-DR-1010; DRL-184-58) Avail: NTIS CSCL 22B

Low speed longitudinal, directional, and lateral static stability characteristics of a straight wing orbiter were determined at a Mach number of .26. The tests were conducted on a .0076 scale model in a 7.75 x 11 foot low speed wind tunnel. Variables investigated included fuselage configuration, wing force and aft location, horizontal tail vertical position, horizontal tail deflections for control, and body build up. Data were obtained over a nominal angle of attack range from -4 deg to 70 deg at 0 deg sideslip angle and over a nominal sideslip angle range from -8 deg to 4 deg at nominal values of 0 deg, 10 deg, 20 deg and 60 deg angles of attack. Author

N71-35114*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: S-IC BOOSTER/GRUMMAN C4 ORBITER DETERMINATION OF DOWNWASH ON 900 SQUARE FEET, 30 DEG ORIENTED S-IC FINS AND OPTIMUM ORBITER BODY AND AERODYNAMIC SURFACE INCIDENCE ANGLES
L. C. Shrout, M. Y. Oiye, and R. M. Miller Feb. 1971 403 p
(Contract NAS8-4016)
(NASA-CR-103195) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Experimental aerodynamic investigations were made during November 1970 in the MSFC 14 x 14 inch wind tunnel on a Saturn S-1C booster coupled to a Grumman C-4 orbiter for the purpose of determining: (1) downwash on 900 sq ft, 30 degree oriented S-1C fins; (2) optimum attachment angle of orbiter to booster; (3) booster fin orientation; (4) directional stability; (5) orbiter wing loads and horizontal tail effectiveness; (6) effectiveness of wing spoilers in reducing downwash; and (7) effects of the strong back, and orbiter wing incidence angle. Data were collected over a Mach number range from 0.6 to 1.96 at angles of attack varying from 13 deg to 13 deg at zero degrees sideslip and for -2 deg to 19 deg sideslip at zero degrees angle of attack. Six component force and moment data were recorded and are presented in plotted form. Author

N71-35115*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: SUBSONIC AERODYNAMIC CHARACTERISTICS OF MDAC/MMC SPACE SHUTTLE BOOSTER CONFIGURATION AT MACH NUMBER 0.26
D. Michna (Martin Marietta Corp.) and G. Holle (Martin Marietta Corp.) Jan. 1971 993 p
(Contract NAS8-4016)
(NASA-CR-103199; DMS-DR-1054; DRL-184-58) Avail: NTIS CSCL 22B

A 0.03 scale model of the MDAC/MMC space shuttle booster was tested in the MDAC low speed wind tunnel to determine the configuration design, stability, and control characteristics. The model was tested at a Mach number of 0.26, Reynolds number of 1,760,000/ft, and a dynamic pressure of 0.695 psi. Airflow through the propulsive canards was used to simulate the mass flow and exit pressure for the cruise back jet engines and its effects with various canard flaps and wing flap deflection. Review of base drag coefficients for power-on and power-off configurations found these data to be in error. The coefficients representative of the power-on configurations have been deleted, and those data for the power-off configuration modified are presented. Author

N71-35116*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF FIRST-DAY SPACE MALFUNCTIONS
A. R. Timmins and R. E. Hauser Washington Sep. 1971 15 p refs
(NASA-TN-D-6474; G-1038) Avail: NTIS CSCL 22B

The first-day performances of 57 Goddard Space Flight Center spacecraft were examined in summary and in detail. A total of 69 malfunctions, of which 45 were classified as failures, have been summarized by year of occurrence, by major subsystem of a spacecraft, by type of defect, and by severity. Despite the 45 first-day failures, the overall performance has been excellent. Of the 57 spacecraft, 27 had no first-day failures, and only five of the first-day failures resulted in unsuccessful missions. Redundancy eliminated the effect of 20 percent of the failures, and design reduced the impact of many other failures. A detailed study of each failure was made to determine the effect of the launch environment and to identify other factors, to judge the effectiveness of the test program, and to distill from the experiences lessons for the improvement of future space programs. Author

N71-35117*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
USE OF ORBIT-TO-ORBIT SHUTTLES FOR HYPERBOLIC RENDEZVOUS WITH RETURNING PLANETARY SPACECRAFT
David R. Brooks and Edwin F. Harrison Washington Sep. 1971 33 p refs
(NASA-TN-D-6342; L-7664) Avail: NTIS CSCL 22A

An earth-return mode is described for interplanetary spacecraft via hyperbolic rendezvous. In this mode an orbit-to-orbit shuttle leaves a circular earth orbit, performs a rendezvous with a returning interplanetary spacecraft as it approaches earth on a hyperbolic trajectory, docks and performs desired transfers, and deboosts back into a circular earth orbit while the spacecraft continues on its hyperbolic path. Two basic flight modes are proposed, and the equations for analyzing the maneuvers are derived. The initial mass in earth orbit required for a rendezvous system utilizing chemical or nuclear propulsion compares favorably with the initial masses in earth orbit chargeable to transport of some conventional Earth-return systems to a target planet and back. In addition, the maneuver has considerable merit as a backup and rescue system. For typical missions, orbit-to-orbit shuttles having initial masses in earth orbit of up to 500,000 kg are required. Author

N71-35118# Royal Aircraft Establishment, Farnborough (England).
TABLE OF EARTH SATELLITES. VOLUME 1: 1957 TO 1968
D. G. King-Hele, H. Hiller, and J. A. Polkington Feb. 1970 p refs
(RAE-TR-70020-Vol-1) Avail: NTIS

All known artificial satellites launched before 1 January 1969 are listed chronologically. Lifetimes, weights, dimensions and orbital details are given for instrumented satellites and their final-stage rockets. Other fragments from satellites are listed without these details. The methods used in compiling the table are described. Author

N71-35119*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A REAL-TIME SPACE STATION DYNAMICS AND CONTROL SYSTEM SIMULATION
Carolyn Grantham and Ralph W. Will Washington Sep. 1971 49 p refs
(NASA-TN-D-6449; L-7733) Avail: NTIS CSCL 22B

A real-time computer-hardware simulation for the investigation of space station dynamics and control problems is described. The simulation utilizes full-scale control moment gyro (CMG) hardware mounted on a moving base simulator, a manual console, and a Control Data (CDC) 6600 digital computer to represent a space station and its control system. The digital computer software is programed in modular form by using separate subroutines or modules to represent the simulated spacecraft, onboard control computer, isolated experiment packages, and other disturbance or dynamics functions associated with space station operation. A complete functional and operational description of the major elements of the space station simulation is included. Author

N71-35120*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
A CONCEPTUAL STUDY OF THE SSV/GN&C SYSTEM

DATA BUS
G. E. Proch Washington NASA Aug. 1971 289 p refs
(Contract NAS8-5191)
(NASA-CR-1792) Avail: NTIS CSCL 22B

The development of a time-shared data bus concept compatible with the Space Shuttle Vehicle/Guidance, Navigation and Control (SSV/GN&C) System functional and operational requirements is reported. The concept evolves from discussion, tradeoffs, and analysis presented under three basic subjects: (1) system data requirements, (2) data management considerations, and (3) data communication techniques. Data requirements for the SSV mission are estimated. Data classes are developed to facilitate their management and transfer. Communication techniques are evaluated to obtain an acceptable data reliability for a minimum hardware constraint. Specific recommendations of data bus features and technical characteristics are stated. A data bus interface assembly is proposed. Author

N71-35121# National Oceanic and Atmospheric Administration, Boulder, Colo.
DEVELOPMENT OF AN ECC OZONESONDE
W. D. Komhyr and J. S. Harris Feb. 1971 59 p refs
(NOAA-TR-ERL-200-APCL-18) Avail: SOD $0.60

An electrochemical concentration cell ozonesonde which was developed for measuring the vertical distribution of atmospheric ozone up to about 35 km is reported. The sondes are flown coupled to National Weather Service or Air Force military type balloon-borne meteorological radiosondes. The Ozonesonde and their performance characteristics are described. Specifications for fabricating the instruments are also presented. Author

N71-35122 National Lending Library for Science and Technology, Boston Spa (England).
RIFMA APPARATUS ON THE MOON
G. Kocharov 13 Apr. 1971 4 p transl. into ENGLISH from Pravda (USSR), 1971
(NLL-M-20426-(5628.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Design criteria and operating principles are presented on a roentgen-isotope-fluorescent method of analysis (RIFMA) instrument, which was installed on Lunokhod-1 in order to analyze the chemical composition of the lunar soil over large areas. The RIFMA apparatus uses a special source to irradiate the surface being examined with X-rays, thereby ionizing the atoms of the different elements in the lunar soil. By recording the radiation which occurs and measuring its energy, the chemical elements in the lunar soil are determined. Proportional counters equipped with characteristic filters are used to register the radiation. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-35123*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
BASIC FAILURE MECHANISMS IN ADVANCED COMPOSITES Final Report, 25 May 1970 - 25 Apr. 1971
J. V. Mullin and V. F. Mazzio Apr. 1971 121 p refs
(Contract NASw-2093)
(NASA-CR-121621; Rept-2929-NO) Avail: NTIS CSCL 20K

Fundamental failure mechanisms in carbon-epoxy composites as a basis for more reliable prediction of the performance of these materials are presented. Single and multiple fiber specimens were tested under several loading conditions and the sequence of failure events was observed. Both HT and HM fibers were studied together with Type A fibers to determine how each interacted with the matrix during the failure process. Each of these fibers was examined in DEN-438 resin which can be modified to obtain a broad range of properties. The major parameter of interest in this study was resin toughness since this is directly related to crack sensitivity. An analytical model for initiation of fracture is presented and serves as a basis for predicting the brittle fracture behavior for a given fiber/matrix system. This model is based on energy release in the vicinity of a single fiber break and the ability of the surrounding matrix to absorb this energy without generating an unstable crack. Author

N71-35124*# George Washington Univ., Washington, D.C.
CRITERIA FOR AND EXTRAPOLATION IN OVERSTRESS MODELS
Nozer D. Singpurwalla and William H. Marchal [1971] 20 p refs
(Grants NGR-09-010-030; NSF GU-3287)
(NASA-CR-121645) Avail: NTIS CSCL 20K

Analytical techniques to yield good extrapolations for overstress life tests are discussed. Some accelerated life test models and criteria for their selection are summarized. The general procedure is applied to each specific model and a summary of the results is presented. The results for each model comprise a formula which gives an estimate of the mean life under normal use conditions and confidence limits for the mean life. Author

N71-35125*# Northrop Corp., Hawthorne, Calif. Aircraft Div.
EVALUATION OF THREE ANALYTICAL METHODS FOR STRUCTURES UNDER RANDOM ACOUSTIC EXCITATION Final Report, Jul. 1970 - Jul. 1971
Chintsun Hwang and W. S. Pi Aug. 1971 58 p refs
(Contract NAS8-26195)
(NASA-CR-119902; NOR-71-102) Avail: NTIS CSCL 20K

An evaluation program on three analytical methods used in the response analysis of plate and shell structures under random acoustic excitation is described. The methods evaluated are: (1) the statistical energy analysis (SEA) method, (2) the modal method, and (3) the Fourier transform method. In order to determine the applicability and the limitations of the methods, the basic assumptions and the formulations of these methods are reviewed. Additional analytical derivations are performed in order to explore the problems involved in the basic formulations of the analyses. Based on the analytical and the supporting experimental work, the workability and applicability of the methods are established. Some of the limitations and restrictions of the methods are postulated and described in detail. Author

N71-35126*# Clemson Univ., S.C. Mechanical Engineering Dept.
OPTIMIZATION OF STRUCTURES TO SATISFY AEROELASTIC REQUIREMENTS Final Report
Carl S. Rudisill 31 May 1971 19 p refs
(Grant NGR-41-001-027)
(NASA-CR-111955) Avail: NTIS CSCL 20K

Equations for finding the derivatives of the flutter velocity of an aircraft with respect to structural parameters were derived. A numerical procedure was developed for determining the values of the structural parameters such that a specified flutter velocity constraint is satisfied and the structural mass is a relative minimum. A search procedure was developed which utilized two gradient search methods and a projected gradient method. The procedure was applied to the design of a cantilevered box beam. A method for the optimization of a complex structure to satisfy a divergence velocity constraint has been developed and tested on a cantilevered box beam. This method is very similar to the method of optimization for a flutter velocity. Author

N71-35127*# Rice Univ., Houston, Tex.
COMPRESSIVE BUCKLING OF PERFORATED PLATE ELEMENTS

W. Pennington Vann [1971] 26 p refs
(Grant NGL-44-006-033)
(NASA-CR-121669) Avail: NTIS CSCL 20K

The compressive buckling performance of perforated plate elements is discussed. An important factor affecting the performance of a perforated plate is the type of applied stress. The four basic loading conditions of and combinations of the conditions are analyzed. Emphasis is placed on light gage steel members in axial compression when one or more plate elements of which the member is composed has circular holes along its centerline. Author

N71-35128*# Martin Marietta Corp., Denver, Colo.
SYNTHESIS OF DYNAMIC SYSTEMS USING FORMA: FORTRAN MATRIX ANALYSIS. VOLUME 1: METHODOLOGY
Richard L. Wohlen May 1971 47 p refs
(Contract NAS8-25922)
(NASA-CR-119877; MCR-71-75-Vol-1) Avail: NTIS CSCL 13M

Solution techniques of structural dynamic systems on an electronic digital computer using FORMA (FORTRAN Matrix Analysis) are studied. FORMA is a library of subroutines coded in FORTRAN 4 for the efficient solution of small and medium size structural dynamics problems of up to 150 degrees of freedom. Author

N71-35129*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
ADVANCED SUBSTRUCTURING TECHNIQUES Final Report
C. E. Jones Jun. 1971 70 p refs
(Contract NAS8-30520)
(NASA-CR-119927; LMSC-HREC-D225003; HREC-0520-2) Avail: NTIS CSCL 20K

Methods and associated digital computer programs developed for evaluating free undamped modes and frequencies and damped transient responses of structural systems mathematically modeled as assemblages of arbitrary substructures are described. A Rayleigh-Ritz solution method is incorporated in which the state of each substructure is represented by a set of generalized displacement functions. Two general purpose computer programs were developed. The Substructure Function Generator program, which is a modification of the dynamics version of the Lockheed-Huntsville Structural Network Analysis Program (SNAP), calculates generalized displacement functions and constructs the corresponding mass and stiffness matrices for substructures mathematically modeled as basic finite element networks. The Substructure Synthesis program forms system mass, stiffness, and damping matrices. Full-matrix eigenproblem solution routines (Cholesky/Householder) compute system undamped modes and frequencies corresponding to specified constraints on system joint motion components. Transient response is computed using coefficients of undamped system modes as generalized coordinates. Author

N71-35130*# Utah Univ., Salt Lake City.
[MECHANICS OF FRACTURE IN ADHESIVE JOINTS] Semiannual Progress Report
M. L. Williams and K. L. DeVries 13 Aug. 1971 78 p refs
(Grant NGL-45-003-029)
(NASA-CR-121857; UTEC-DO-71-155) Avail: NTIS CSCL 20K

The need for cooperation between continuum mechanics and chemistry is required as a matter of technological necessity in understanding the quality and efficiency of adhesive bonds. A method for associating the mechanical and chemical structure parameters, called the interaction matrix, is described as a device through which the required collaboration can be effectively channelled. Author

N71-35131*# Scientific Translation Service, Santa Barbara, Calif.
PROPAGATION OF CRACKS IN COMPOSITE MATERIALS [O RASPROSTRANENII TRESCHIN V KOMPOZITNYKH MATERIALAKH]
V. V. Panasyuk et al Sep. 1971 6 p refs Transl. into ENGLISH from Fiz.-khim. Mekh. Mater. USSR, v. 7, no. 1, 1971 p 108-110
(Contract NASw-2035)
(NASA-TT-F-13934) Avail: NTIS CSCL 20K

To determine the critical equilibrium, a study was made of a two-component composite containing a crack originating along the diameter of a round inclusion and entering with one tip into the binder. Diagrams were constructed to define the propagation direction of the crack depending on: (1) different loading patterns, (2) different inclusion or crack geometries, and (3) physico-mechanical material characteristics of the inclusion and binder. Author

N71-35132*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LIGHT INTENSITY STRAIN ANALYSIS Patent Application
Jerry G. Williams, inventor (to NASA) Filed 28 Apr. 1971 25 p
(NASA-Case-LAR-10765-1; US-Patent-Appl-SN-138230) Avail: NTIS CSCL 20K

A process is presented for the analysis of the strain field of structures subjected to large deformations with low modulus substrate having a high modulus, thin coating. The optical properties of transmittance and reflectance are measured for the coated substrate while stressed and unstressed to indicate the strain field on the coated substrate. NASA

N71-35133# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
OPTIMAL PLASTIC DESIGN OF DOUBLY SYMMETRIC CLOSED STRUCTURES
S. C. Batterman and L. P. Felton May 1971 39 p refs
(TAE-128) Avail: NTIS

Optimal plastic design of doubly symmetric closed ring and frame structures of idealized sandwich section is formulated utilizing the Marcal-Prager optimization method. Results are presented for elliptical rings and rectangular frames under uniform internal pressure. As the design load increases, the elliptical ring requires consideration of two optimal design configurations while the rectangular frame requires consideration of eight distinct possible design configurations. Total cost curve, a function of design load, is presented, and results for pure bending are obtained. Author

N71-35134# Aeronautical Research Labs., Melbourne (Australia)
CONSIDERATIONS RELEVANT TO THE VIBRATION TESTING OF AERONAUTICAL STRUCTURES HAVING NONIDEAL CHARACTERISTICS
M. G. Chandivert Dec. 1970 25 p refs
(ARL/SM-355) Avail: NTIS

The nonlinear features of the response of aeronautical structures to dynamic excitation forces are presented. In order to make the description of the structures more realistic, possible additions to the usual linear terms in the dynamical equations are considered. Possible consequences of a limited generalization of the linear framework usually assumed are reviewed with reference to the concept of mode and influence of initial conditions. Author

N71-35135# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
ASPECTS OF THE BRITTLE FRACTURE FAILURE OF A 30 INCH ID, 30000 psi ISOSTAT WITH THREADED CLOSURE
H. A. Pohto 30 Apr. 1971 39 p refs
(Contract W-7405-eng-26)
(Y-1758) Avail: NTIS

Failure analysis results are presented for a 30-in. i.d. by 120-in. deep, vertical-standing isostat, designed for a 30,000 psi

operating pressure, which ruptured abruptly during its 1,554th cycle of operation. The pressure vessel was of multiwall, threaded-closure construction. It was ascertained that a brittle fracture occurred, originating at the root of the first thread of the lower closure. A thorough study was made of the factors that contributed to the failure, and a comparison was made of the calculated stresses of a post-failure analysis to the actual stress-strain data obtained from the root of the threads of a vessel considered to be a twin of the fractured isostat. Author

N71-35136# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.
A STUDY OF THICKNESS EFFECTS IN PLATES AND LAMINATES
S. Srinivas, A. K. Rao, and C. V. Joga Rao 1970 88 p refs Prepared for Ministry of Defence
(AE-272-S) Avail: NTIS

An exact three-dimensional analysis of statics and dynamics of orthotropic laminates is developed and applied to some rectangular plates and laminates made up of isotropic or orthotropic materials. These are used to study the results of the simplifications, which are broadly called thickness effects, in thin plate, Reissner and Mindlin type formulations and their dependence on thickness, orthotropy, inter-ply modular ratios and boundary conditions. A general solution is developed for the governing differential equations of three-dimensional linear elasticity in rectangular Cartesian coordinates. This solution consists of twelve sets of double Fourier series of trigonometric-hyperbolic terms. Using suitable parts of this general solution a variety of problems can be solved. One set in the general solution yields a simple and elegant exact solution for a class of simply supported rectangular plates and laminates, in which the simple support is provided by a diaphragm infinitely rigid in its own plane but absolutely flexible to stresses normal to its plane. When the lateral surfaces are subjected to either static or harmonic forcing functions, the solution is in series form in which each term is explicitly determined from a set of simultaneous equations in 6p unknowns, p being the number of plies. In case of free vibrations and buckling, the natural frequencies and buckling stresses are defined by closed form transcendental characteristic equations. This particular class of plates and laminates, either of isotropic or orthotropic materials, is studied extensively and thickness effects in the interior are discussed. Author

N71-35137# New South Wales Univ., Kensington (Australia). School of Civil Engineering.
IMPROVED FINITE DIFFERENCE VARIANT FOR THE BENDING ANALYSIS OF ARBITRARY CYLINDRICAL SHELLS
A. K. Noor and V. K. Khandelwal Dec. 1969 226 p refs
(UNICIV-R-58) Avail: NTIS

Several variants of the finite-difference method are applied to the bending analysis of closed and open, circular and noncircular cylindrical shells with constant and variable rigidity. The study is based on the Sanders-Budiansky first approximation theory. The governing differential equations are formulated in four different ways: (1) in terms of the three displacement components of the middle surface, (2) in terms of four second-order ordinary differential equations, (3) eight first-order ordinary differential equations, and (4) thirteen first-order partial differential equations. The effects of variations in loading, shell geometry (curvature and thickness), and edge perturbations on the accuracy and convergency of the different finite-difference variants are discussed. Primary attention is given to the analysis of shells having the curved edges simply supported, however, shells with other types of support conditions along the curved edges are also considered. Author

N71-35138# McGill Univ., Montreal (Quebec). Dept. of Mechanical Engineering.
DYNAMICAL ANALYSIS OF AXIALLY NONUNIFORM, THIN CYLINDRICAL SHELLS. PART 2: FREE VIBRATION
A. A. Lakis and M. P. Paidoussis Jan. 1971 37 p refs Sponsored by Natl. Res. Council of Can. and Atomic Energy of Can. Ltd.
(MERL-70-10) Avail: NTIS

The free flexural vibration characteristics of thin cylindrical shells are studied by a hybrid finite element theory, in which the displacement functions are determined by solution of the cylindrical thin-shell equations. Uniform shells with simply-supported clamped and free ends are studied, as well as ring-stiffened shells and shells with thickness discontinuities. The frequencies of vibration agree well with those obtained by other theories and experiments. Author

N71-35139# Technische Hogeschool, Delft (Netherlands). Lab. of Engineering Mechanics.
THE INTERACTION BETWEEN LOCAL BUCKLING AND OVERALL BUCKLING ON THE BEHAVIOUR OF BUILT-UP COLUMNS
W. T. Koiter and G. D. C. Kuiken May 1971 29 p refs
(WTHD-23; Rept-447) Avail: NTIS

Using the general nonlinear theory of elastic stability, the imperfection sensitivity of a column composed of two flat panels at a constant distance is investigated. Where the separate phenomena of local buckling and overall buckling occur at the same stress, the interaction between both phenomena in the built-up structure produces failure of the column at much lower stresses, due to the high sensitivity to imperfections of the idealized model of the structure. Author

N71-35140# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON A METHOD OF SOLVING STABILITY AND VIBRATIONS PROBLEMS OF SHELLS OF REVOLUTION
E. I. Grigoliuk et al 1971 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverd. Tela (USSR), no. 1, 1971 p 9-19
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A method is developed for solving stability and vibrations problems of shells of revolution, which is based on the direct integration of the equilibrium equations. By using the method of reducing the boundary value problem to a Cauchy problem, the solution is reduced to seeking the roots of some characteristic equation whose form depends on the boundary conditions taken. To obtain a stable integration process, an intermediate orthonormalized solution is utilized. As an illustration, the stability of isotropic conical shells subjected to hydrostatic pressure is investigated. The results are presented in a form convenient for practical utilization. Author

N71-35141# Technion - Israel Inst. of Tech., Haifa. Material Mechanics Lab.
A LARGE DEFORMATION ELASTIC-VISCOPLASTIC ANALYSIS OF A THICK WALLED SPHERICAL SHELL
S. R. Bodner and Y. Partom Nov. 1970 45 p refs
(Contract F61052-69-C-0042)
(AD-722867; MED-31; Scientific-7; AFOSR-TR-71-1096) Avail: NTIS CSCL 20/11

A large deformation elastic-viscoplastic theory is formulated which considers both elastic and inelastic deformations to be present at all stages of loading and unloading. The theory does not require the assumption of a yield criterion or the prior determination of whether the material is loading or unloading. The theory is based on relating the essential parameters to state variables; the particular constitutive relations are motivated by the equations of dislocation dynamics. A numerical scheme for calculating deformations is developed and applied to a thick walled spherical shell under internal pressure. Various numerical examples are presented. Author (GRA)

N71-35142# Brown Univ., Providence, R.I. Div. of Engineering.
THE DYNAMIC STRESS-STRAIN BEHAVIOR IN TORSION OF 1100-0 ALUMINUM SUBJECTED TO A SHARP

INCREASE IN STRAIN RATE
R. A. Frantz, Jr. and J. Duffy Feb. 1971 36 p refs
(Contract DAHC04-70-C-0035)
(AD-722869; TR-1; AROD-9288-1-E) Avail: NTIS CSCL 11/6

A modification of the torsional split Hopkinson bar is described which superimposes a high rate of shear strain on a slower static rate. The static rate of 0.00005/sec is increased to 850/sec at a predetermined value of plastic strain by the detonation of small explosive charges; the rise time of the strain rate increment is about 10 microseconds. During deformation at the dynamic rate, direct measurement is made of the excess stress above the maximum static stress attained. Results for 1100-0 aluminum show that the initial response to the strain rate increment is elastic, followed by yielding behavior reminiscent in appearance to an upper yield point. The magnitude of the stress measured at this yield point is always less than the stress obtained at the same strain in a wholly dynamic test; as the stress-strain curve asymptotically. It is concluded that the material behavior is a function of strain, strain rate and strain rate history. Author (GRA)

N71-35143# Oak Ridge National Lab., Tenn.
HEAVY-SECTION STEEL TECHNOLOGY PROGRAM Semiannual Progress Report, period ending 31 Aug. 1970
Apr. 1971 65 p refs
(Contract W-7405-eng-26)
(ORNL-4653) Avail: NTIS

Efforts by engineering, fabrication, and utility groups to assess the in-service structural safety of heavy-section pressure vessels are reported. Information is included on program administration, results of tests on irradiated and unirradiated materials, and results of pressure vessel investigations. NSA

N71-35144# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
GREEN'S FUNCTIONS FOR ANISOTROPIC ELASTICITY
N. Kinoshita and T. Mura [1970] 22 p refs Sponsored by AEC
(COO-2034-5) Avail: NTIS

Green's function describing the elastic displacement caused by a unit force in an infinitely extended anisotropic media are obtained in series form. The series and its derivatives uniformly converge contrary to the Green's functions obtained by previous investigators. The results are applicable to any type of anisotropy. A special example, requiring no computer calculation, is given for the case of cubic crystals. Author

N71-35145# Northwestern Univ., Evanston, Ill. Dept. of Civil Engineering.
ELASTIC FIELDS OF INCLUSIONS IN ANISOTROPIC MEDIA
N. Kinoshita and T. Mura [1970] 19 p refs Sponsored by AEC
(COO-2034-4) Avail: NTIS

The displacement and stress fields caused by eigen-strains (thermal expansion, plastic strain, phase transformation, etc.) distributed uniformly inside a domain of infinitely extended anisotropic media are expressed in a series form and also in an integral form. These forms provide not only the method of stress analysis but also investigation of Eshelby's proposition that the stress in domain is constant. Author

N71-35146# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
METHOD FOR DETERMINING THE FRACTURE STRENGTHS OF LOW-DUCTILITY MATERIALS SUBJECTED TO SHOCK-WAVE LOADING
John G. Avery and James F. Norris 24 Mar. 1971 9 p refs
(Contract AT(29-1)1106)
(RFP-1554) Avail: NTIS

A novel method is introduced for testing the resistance of a brittle material to fracture when it is subjected to a shock wave loading. An inexpensive and simple mechanical method is used to measure the peak stress of the shock wave; the wave may be generated by explosive detonation or electrical discharge. The method of testing makes it possible to compare between different materials, or different processing variables on the same material, to determine the optimum processing and material for the particular application. Author (NSA)

N71-35147*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF A GENERAL STRESS, STRAIN-RATE, TEMPERATURE CORRELATION FOR WELDED THICK-WALLED N-155 TUBES UNDERGOING SECONDARY CREEP FROM INTERNAL PRESSURE
Richard E. Morris Washington Sep. 1971 16 p refs
(NASA-TM-X-2372; E-6398) Avail: NTIS CSCL 20K

A correlation equation relating creep deformation of tubes to a function of stress and temperature is presented. The equation was fitted to experimental N-155 tube test data with a multiple linear regression analysis. A design procedure is proposed and applied to the design of a heat-exchanger tube. Design calculations showed that a welded, thick-walled, N-155 heat-exchanger tube having an outside diameter of 0.635 cm and an inside diameter of 0.391 cm was satisfactory for 10,000-hr service life at 1089 K (1500 F), with 10.34 MN/sq m (1500 psi) internal pressure, and with a limitation of 1 percent on creep deformation during service life. Author

N71-35148*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THERMAL DISTORTION OF PARABOLOIDAL SHELL
Robert J. Platt, Jr. and Marvin D. Rhodes Washington Sep. 1971 25 p refs
(NASA-TN-D-6471; L-7667) Avail: NTIS CSCL 20K

The results are presented of an experimental program to determine the deformations of a paraboloidal shell subjected to axisymmetric thermal loads. Measured local rotations of the shell surface are compared with those determined by two theoretical formulations. The results indicate generally good agreement. Author

N71-35149+ National Aerospace Lab., Amsterdam (Netherlands).
ON THE FORMATION OF FATIGUE STRIATIONS
C. Q. Bowles and D. Broek [1971] 20 p refs Revised
(NLR-MP-69014-U) Avail: NTIS

Thin foils of an aluminium alloy containing fracture surfaces were studied in the electron microscope. The fatigue striations were visible due to thickness contrast and bands of dislocations. Supplementary etch pit studies and stereographic measurements were carried out. It was found that in many cases the crack plane was close to (100) or (110). The mechanism of fatigue crack propagation is discussed in light of the new evidence. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-35150*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
THERMAL CONTROL FOR MOBILE PACKAGES IN THE DUSTY LUNAR ENVIRONMENT
Richard H. Baker and Richard J. Langley Jun. 1971 83 p refs

(Contract NAS9-11540)
(NASA-CR-121874; TR-71-2) Avail: NTIS CSCL 20M

Passive thermal protection concepts are developed to improve the thermal performance of simple radiative surfaces in mobile, dusty, lunar environments. The concepts consist of secondary surfaces which shade the primary surface at high solar elevations, thus, lowering the maximum temperatures incurred. At low solar elevations, the secondary blocks radiation from the primary surface and thereby raises its minimum temperature. Optimization parameters for dual surface configurations are illustrated. Several methods of raising the minimum temperature of the primary surface at low solar elevations are discussed including solar powered heaters, variable area primary surfaces, glass covered high absorptance materials, and conical secondaries. Various means of lowering the maximum temperatures incurred by the basic dual surface design are described including multicharacteristic materials, conical secondary surfaces, and infrared radiation shields. Author

N71-35151*# Louisiana State Univ., Baton Rouge. Dept. of Mechanical and Aerospace Engineering.
THE EFFECTS OF WATER IMPINGING ON THERMALLY CONTROLLED SURFACES UNDER SPACE CONDITIONS
D. Maples and M. H. Spiller [1971] 71 p refs
(Grant NGR-19-001-068)
(NASA-CR-121870) Avail: NTIS CSCL 20M

The results of an investigation to experimentally determine the monochromatic reflectance changes caused from an impinging water spray on thermally-controlled paints are presented. After reaching thermal equilibrium with their space environment, the paint samples were struck with water ejected from a sharp-edge nozzle. An integrating sphere was constructed to measure the reflectance changes after exposure to the water jet. Inconclusive results were obtained because the water droplets failed to freeze solidly before impingement. High speed motion pictures taken of the spray during impact showed the particles consisted of thin shells of ice with liquid centers. Visible surface damage occurred to one of the paints, although the integrating sphere was unable to measure a change in reflectance. Author

N71-35152*# Rocketdyne, Canoga Park, Calif.
ADVANCED IGNITION SYSTEMS Final Report, 30 Jul. 1971
30 Jul. 1971 134 p refs
(Contract NAS8-25126)
(NASA-CR-119928; R-8756) Avail: NTIS CSCL 21B

Two ignition system concepts were experimentally evaluated during laboratory testing for application in hydrogen/oxygen engine system incorporating a multiple-combustor thrust chamber. Both concepts, designated the resonant flow igniter and the combustion wave igniter, proved operationally feasible for the specific engine system application. The ignition concepts are unique and can be used to ignite any hydrogen/oxygen combustion device. The ignition system design requirements are discussed, ignition system configurations for a specific application are described, and the results of feasibility testing with prototype igniter hardware are detailed. Author

N71-35153*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A PROTECTED ISOTOPE HEAT SOURCE Patent Application
Raymond K. Burns, inventor (to NASA), Lloyd I. Shure, inventor (to NASA), and Elliott D. Katzen, inventor (to NASA) Filed 28 May 1971 9 p
(NASA-Case-LEW-11227-1; US-Patent-Appl-SN-146939) Avail: NTIS CSCL 20M

A radioactive isotope capsule is described which is disposed in a container (heat shield) which has a single stable trim attitude when reentering the earth's atmosphere and while falling to earth. The center of gravity of the heat source is located forward of the mid-point between the front face and the rear face of the container. The capsule is insulated from the front face of the container but not from the rear surface of the container. NASA

N71-35154*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DISCONNECT UNIT Patent Application
Paul Alexander, Jr., inventor (to NASA) and Allan R. McDougal, inventor (to NASA) Filed 24 Feb. 1971 22 p
(Contract NAS7-100)
(NASA-Case-NPO-11330; US-Patent-Appl-SN-118269) Avail: NTIS CSCL 20M

A squib actuated disconnect for use in releasably coupling a spacecraft with its launch vehicle is described. The squib is characterized by an expandable collet axially extended from a first tension member for receiving in locking engagement a protuberance axially extended from a second tension member. A gas driven retainer of an annular configuration supports the collet and is held in a position to permit release of the spacecraft when the squib is fired. NASA

N71-35155# National Physical Lab., Teddington (England). Aerodynamics Div.
CALCULATION OF BOUNDARY LAYER DEVELOPMENT USING THE TURBULENT ENERGY EQUATION. 8: COMPRESSIBLE HEAT TRANSFER
P. Bradshaw (Imp. Coll.) and D. H. Ferriss Sep. 1970 21 p refs
(NPL-Aero-1325; ARC-32-401; FM-4174) Avail: NTIS

A method of predicting compressible heat transfer in low speed flow with small temperature differences was treated, using the hypothesis that the statistical properties of the temperature fluctuation field are uniquely specified by the heat flux and shear stress profiles. Empirical functions, defined as the thermal analogues of the parameters mentioned above are also given. Author

N71-35156# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
THE POSSIBLE ROLE OF ELEMENTARY PARTICLE PHYSICS COSMOLOGY
R. Omnes Apr. 1971 119 p refs Submitted for publication
(LPTHE 71/15) Avail: NTIS

The thermodynamic behavior of a system of particles at ultrahigh temperatures and the astrophysical consequences of these effects in the framework of an evolutionary isotropic universe are reviewed in relation to the problems of the origin of matter and galaxies. Author

N71-35157# Politecnico di Torino (Italy).
JOULE-THOMSON COEFFICIENT FOR WATER VAPOR [IL COEFFICIENTE DI JOULE-THOMSON PER IL VAPOR D'ACQUA]
Paolo Gregorio Sep. 1970 22 p refs in ITALIAN; ENGLISH summary Presented at the 25th Congr. Nazl. ATI, Trieste, 21-25 Sep. 1970
(PT-IFT-391) Avail: NTIS

A thermodynamic definition and the correlations are given for computing the isenthalpic Joule-Thomson coefficient. Using the Keenan and Kayes fundamental equation, the Joule-Thomson coefficient is calculated for pressurized water, superheated steam and saturation conditions. The law of corresponding states is then applied by comparing calculated reduced values to the experimental results available for air. The results (given in diagrams) are discussed. Author

N71-35158# Arizona Univ., Tucson. Engineering Experiment Station.
POWER PLANT HEAT REJECTION IN AN ARID CLIMATE
Frederic Cook Scofield, III [1971] 92 p refs
(EES-33) Avail: NTIS

Factors affecting the site selection process in a dry climate are reviewed and the criteria for evaluating water sources are developed and applied to Arizona. Cooling towers, cooling ponds, and cooling ponds with sprays are three systems of evaporative heat dissipation investigated for a location representative of central Arizona. The results of the investigation were applied to a typical 800Mwe nuclear PWR power plant. Author

N71-35159# Naval Weapons Lab., Dahlgren, Va.
CONVECTION IN INTERNALLY HEATED FLUID LAYERS. PART A: BIFURCATION ANALYSIS
Ernst W. Schwiderski Apr. 1971 66 p refs
(AD-723816; NWL-tr-2554) Avail: NTIS CSCL 20/13

A strictly hexagonal convection flow in an electrolytically heated fluid layer is found to be inconsistent with the rectangular pattern of the oriented electric field. In agreement with experiments any hexagonal motion must be expected to be more or less disturbed by the uneven internal heating. A Lyapunov-Schmidt analysis resulted in a comprehensive display of the bifurcation phenomenon. An intrinsic resonance mechanism between the coupled linear and nonlinear forces introduces a natural discretization which seems to determine the physically preferred mode. Author (GRA)

N71-35160# California Univ., Berkeley. Structural Engineering Lab.
NON-LINEAR HEAT TRANSFER ANALYSIS OF AXISYMMETRIC SOLIDS
Iraj Farhoomand and Edward L. Wilson Apr. 1971 75 p refs
(PB-199169; UCSESM-71-6) Avail: NTIS CSCL 20M

The finite element method as applied to heat transfer problems is modified and a technique is developed for the evaluation of the temperature in two-dimensional axisymmetric bodies. Based on this approach a general digital computer program is developed for two-dimensional axisymmetric systems of arbitrary geometry. The nonlinearity effects of conduction, radiation, convection, and cooling pipe forms of heat transfer are considered by the program. GRA

N71-35161# California Univ., Livermore. Lawrence Radiation Lab.
RADIATION TEMPERATURE IN SOLIDS UNDER SHOCK LOADING
Paul A. Urtiew and Richard Grover 15 Apr. 1971 25 p refs
Presented at 5th Symp. on Temp., Washington, D. C., 21 Jun. 1971 Sponsored by AEC
(UCRL-73150; Conf-710604-1) Avail: NTIS

An experimental technique for measuring the temperature of a material under shock loading is described. Temperature has been determined analytically on the basis of several theoretical assumptions. The new ability to measure temperature will not only provide a check against the theoretical determination of temperature but will also be useful in detecting melting along the shock Hugoniot and in checking the Hugoniot results against static predictions. The new technique is based on the ability to measure the amount of thermal radiation emitted from a shock-heated surface supported by transparent material and detected by photoelectric devices capable of responding to a change that occurs within a few nanoseconds. Observations are limited to the sensitivity of the diodes which covers some of the visible and part of the near infrared energy spectrum. Author

N71-35162*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USE OF HIGH CONDUCTIVITY CLADDING MATERIAL ON D-SHAPED COOLANT PASSAGES IN NOZZLES TO REDUCE TUBE-WALL CREST TEMPERATURES
Ronald G. Huff and Frank S. Mollo Washington Sep. 1971 9 p refs
(NASA-TN-D-6422; E-6369) Avail: NTIS CSCL 20M

Calculations of wall temperatures in a rocket engine cooling tube having a D-shaped cross section have been made using heat-transfer conditions that are typical of liquid-hydrogen-cooled, high-thrust rocket engines. Copper, 347 stainless-steel, and copper-clad stainless-steel tubes were investigated. It was found that for tube semicircular radii of the order of 0.133 cm a reduction of the stainless-steel tube-wall crest temperature of 150 K is possible by cladding the stainless with 0.229 cm thick copper. Tubes made entirely of copper will yield crest temperatures of the order of 350 K below the 767 K stainless-steel tube temperature if the tube radii are of the order of 0.133 cm. Author

N71-35163*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HEAT-TRANSFER EXPERIMENTS ON A 34-AMPERE-HOUR NICKEL-CADMIUM CELL
Curt H. Liebert Washington Sep. 1971 21 p refs
(NASA-TM-X-2371; E-6391) Avail: NTIS CSCL 10C

Local transient temperature distributions throughout the plate pack of operating nickel-cadmium cells and accompanying jar temperatures are reported for a 34-ampere-hour cell. The cell was charged at 7 amperes and was discharged into the exhaustion region at constant currents ranging from 16 to 68 amperes. Temperature distributions were recorded for a variety of heat-transfer conditions which could be encountered in practical battery applications. At given times, average theoretical temperatures calculated by use of transient lumped heat transfer models predicted local experimental temperatures within + or - 4 percent. This suggests that simple lumped theory can be applied with confidence to thermal design of nickel-cadmium batteries. Author

N71-35164# Royal Inst. of Tech., Stockholm (Sweden).
ON THE DETERMINATION OF THERMODYNAMIC RELATIONSHIPS IN STEADY FLOW PROCESSES
Nils-Erik Fagerholm 1971 37 p refs
(PB-199759; APS-PH-74) Avail: NTIS CSCL 20D

An attempt is made to introduce the concept of a process equation, from which thermodynamic relationships can be obtained. The purpose is to get simple and useful formulae without giving up any claims on generality. The pressure and temperature ranges tend to widen in engineering practice and this fact brings a need of general formulations into a greater prominence. Author (GRA)

N71-35165 Ohio State Univ., Columbus.
AN EXPERIMENTAL INVESTIGATION OF THE ROLE OF RESONANCE HEATING IN THE AUTOIGNITION OF FLOWING COMBUSTIBLE GAS MIXTURES
Larry Allen Diehl (Ph.D. Thesis) 1970 128 p
Avail: Univ. Microfilms Order No. 70-19306

The phenomena of autoignition as reported by several authors has been investigated; the purpose being to obtain a plausible explanation for these occurrences. Autoignition of flowing hydrogen-oxygen mixtures was found to occur for certain flow conditions and apparatus configurations. For these cases in which diametrically opposed flow conditions exist resonant heating, producing temperatures of 770 K, resulted. Resonance heating may also be partially responsible for the apparent low ignition temperatures reported by several authors for flowing hydrogen-oxygen and hydrogen-air mixtures. Streak schlieren photographs are obtained of the resonance phenomena occurring within the fuel feed line. On the basis of this information the minimal flow rates necessary to produce autoignition can be predicted. A technique has been devised whereby the instantaneous temperature occurring within any portion of the resonating fuel line may be determined from the streak photographs. Dissert. Abstr.

N71-35166 National Lending Library for Science and Technology, Boston Spa (England).
THE LINK BETWEEN THE HEAT TRANSFER CRISIS AND HIGH FREQUENCY NATURAL PRESSURE OSCILLATIONS

N. L. Kafengauz 5 Apr. 1971 8 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Belorussia), v. 17, no. 4, Oct. 1969, p 725-729
(NLL-CE-Trans-5620-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A hypothesis is developed that the process of heat transfer during surface liquid boiling and, in particular, the heat transfer crisis are inseperably linked with high-frequency pressure fluctuations accompanying the process. Data are presented showing that the effects of pressure and fuel element geometry on heat transfer, distribution of wall temperature along tube length, the place of heat transfer crisis onset and frequency of vapour bubble formation depend on the amplitude-frequency characteristics of pressure fluctuations. Author

34 GENERAL

Includes information of a broad nature related in industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N71-35167*# IIT Research Inst., Chicago, Ill.
AID/NASA PILOT PROJECT IN TECHNOLOGY TRANSFER TO A DEVELOPING NATION, KOREA. PHASE 2: TRAINING OF KOREAN SPECIALISTS Semiannual Report
Dec. 1970 153 p refs
(Contract NASw-2083)
(NASA-CR-121705; V6110-7) Avail: NTIS CSCL 05I

A detailed description and critique are presented of the project organization and communications activities for training Korean specialists in transfer methods and technology resources. Background information on the program scheduling and a critique prepared by the Korean participants are included along with conclusions and recommendations. J.M.

N71-35168*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md. National Space Science Data Center.
THE NATIONAL SPACE SCIENCE DATA CENTER HANDBOOK OF CORRELATIVE DATA
Joseph H. King, (ed.) Feb. 1971 210 p refs
(NASA-TM-X-67294; NSSDC-71-05) Avail: NTIS CSCL 05B

This handbook of correlative data contains six major discipline oriented parts covering galactic cosmic rays, solar electromagnetic radiation, energetic solar protons, geomagnetism, the ionosphere, and the neutral atmosphere. In addition, miscellaneous data is presented on magnetospherically trapped particles, solar wind, airglow, aurora, calendar records, activity charts, and Jovian radio emission. Also included are a listing and discussion of the major sources of the data. A.L.

N71-35169*# Smithsonian Institution, Washington, D.C.
[INTERDISCIPLINARY COMMUNICATIONS CONFERENCES] Annual Report, period ending 31 Dec. 1970
9 Apr. 1971 26 p
(Contract NSR-09-015-044)
(NASA-CR-121858) Avail: NTIS CSCL 05B

Conferences held under the sponsorship of the Interdisciplinary Communications Program included those on populations, space technology utilization, and origins of life. The general theme of the conferences is presented, along with the status of future conferences on these subjects. A.L.

N71-35170# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).
DESCRIPTION OF THE INSTITUTE AND WORKS PERFORMED DURING THE SUMMER OF 1969 [PORCCHILO O DELU INSTITUTA V LETU 1969]
Andrej Smalc Mar. 1970 34 p refs In SERBO-CROATIAN
(IJS-253) Avail: AEC Depository Libraries

Following a general introduction and overview of the work and its purpose, the various divisions are discussed in detail including physics, chemistry, biochemistry, mathematics, reactor, radiation safety, and information. The organization is described, with names of individuals in various positions, and publications in journals, books, conference proceedings, and other literature are listed for each section of each division. NSA

N71-35171# Middle East Technical Univ., Ankara (Turkey).
GROWTH IN TURKISH POSITIVE BASIC SCIENCES, 1933 - 1966
A. Kemal Oezinoenue 1970 76 p refs
(Publ-17) Avail: NTIS

Data are collected on the measurable qualities of Turkish science in terms of high level scientific manpower, scientific fertility from 1933 to 1966, and scientific productivity. Data cover (1) variable number of scientists in basic disciplines, (2) the nature of variability, (3) length and nature of formal education of scientists and length of service within each academic rank, (4) average number of young scientists, and (5) present resources in the basic sciences. E.H.W.

N71-35172# Danish Academy of Technical Sciences, Copenhagen.
THE ATV FAMILY, 1971
1971 30 p
Avail: NTIS

Descriptive information is presented on the organization and services of the university research committees and independent industrial research institutions. The cooperative endeavors are in the field of promoting scientific and technological research and the application of the results. N.E.N.

N71-35173# Royal Aircraft Establishment, Farnborough (England).
DEFENCE RESEARCH ABSTRACTS: UNCLASSIFIED ISSUE 69/70-1 [FROE FORSVARS FORSKNINGS REFERAT. OEPPEN DEL]
May 1970 44 p Transl. into ENGLISH from the Swedish quarterly
(RAE-LIB-TRANS-1454) Avail: NTIS

Summary reports and abstracts include studies on the following: nuclear reactions, chemical and biological warfare, conventional warfare, applied physics, teletechniques, biotechnology, military psychology, psychological defense, and systems analysis. Author

N71-35174# Royal Aircraft Establishment, Farnborough (England).
A METHOD OF CALCULATING THE EFFECT OF CONVENTIONAL WEAPONS ON DIFFERENT TYPES OF TARGET, VERSION 1 [METOD ATT BERAEKNA KONVENTIONELLA STRIDSDELARS VERKAN I OLIKA TYPER AV MAL, VERSION 1]
M. Hagwall Jan. 1970 24 p Transl. into ENGLISH from the Swedish report A-2500-45, Sep. 1967
(RAE-LIB-TRANS-1420) Avail: NTIS

A two part statistical model is outlined whereby the effects may be determined of fragmenting HE weapons, of given tactical performance and delivery accuracy, against a composite target described in terms of components of uniform function and vulnerability. In the first part, for a number of simulated attacks, individual component kill probabilities are calculated and used in the second part to estimate the probability of the target as a whole ending up in various states. The model also comprises an attempt to simplify the target description by correlating the number of hits on a set of notional presented surfaces to their effect on the target. The model was applied to the attack of radar stations and missile formations, and attack by a wave of aircraft is mentioned. Author

N71-35175# Committee on Public Works (U. S. Senate).
THE ECONOMICS OF CLEAN AIR Annual Report of the Administrator of the Environmental Protection Agency to the Congress of the United States
William D. Ruckelshaus Washington GPO 1971 196 p refs Rept. presented by Comm. on Public Works at the 92d Congr., 1st Sess., 16 Mar. 1971
(S-Doc-92-6) Avail: SOD $1.00

Twenty-three types of stationary air pollution sources are discussed under three major categories. The section on solid waste disposal gives estimates of the costs of controlling air pollution arising from open burning and incineration. Four types of fuel combustion sources are covered in the second section: (1) steam-electric power plants, (2) industrial boilers, (3) commercial-institutional heating plants, and (4) residential heating plants. The third section covers industrial process sources within the following industries: (1) kraft (sulfate) pulp, (2) iron and steel, (3) gray iron foundry, (4) sulfuric acid, (5) petroleum refining, (6) asphalt batching, (7) cement, (8) primary nonferrous metallurgy, (9) phosphate fertilizer, (10) lime, (11) coal cleaning, (12) petroleum products storage, (13) grain milling and handling, (14) varnish, (15) rubber (tires), (16) secondary nonferrous metallurgy, (17) elemental phosphous, and (18) brick and tile. One mobile source, motor vehicles, is discussed.
Author

N71-35176# Atomic Energy Commission, Washington, D.C.
ENVIRONMENTAL CONSIDERATIONS IN THE REGULATORY PROCESS FOR PLANTS IN THE U.S.: THE ROLE OF THE PUBLIC AND PUBLIC UNDERSTANDING
James T. Ramey 13 Aug. 1971 25 p refs Presented at the Intern. Atomic Energy Agency Symp. on Environ. Aspects of Nucl. Power Plants, N. Y., 13 Aug. 1970
(IAEA-SM-146/5) Avail: NTIS

The proceedings of a conference on the licensing and control of nuclear power plants are presented. Subjects discussed are: (1) growth of electric power needs, public participation in regulatory procedures for nuclear reactor use, (3) reactor licensing, and (4) international cooperation. P.N.F.

N71-35177# Committee on Interior and Insular Affairs (U. S. Senate).
LAW AND THE ENVIRONMENT: SELECTED MATERIALS ON TAX EXEMPT STATUS AND PUBLIC INTEREST LITIGATION
Washington GPO 1970 48 p refs Rept. presented by the Comm. on Interior and Insular Affairs, 91st Congr., 2d Sess., 9 Nov. 1970
Avail: US Capitol, Senate Document Room

Private litigation is beginning to be an important element of the national effort to preserve and enhance the quality of our environment. Increasingly, concerned Americans are turning to the courts to enforce existing laws and develop case law establishing new environmental rights. The Committee on Interior and Insular Affairs has followed the growth of litigation in this area with close interest, particularly because of its responsibility for the development of the National Environmental Policy Act. In the brief period since it became law, this act has provided the basis for a number of legal actions aimed at requiring Federal agencies to live up to their environmental responsibilities. Many of the organizations involved in environmental litigation have received tax-exempt status as charitable organizations under section 501(c)(3) of the Internal Revenue Code. The action by the Internal Revenue Service is suspending rulings on claims for such status by organizations involved in litigation has created understandable uncertainty about the future of this kind of litigation. It has stimulated controversy over the use of the tax-exempt status and the role of public interest litigation in general. An IRS study of these matters is presented. Author

N71-35178# Committee on Public Works (U. S. Senate).
OIL SLUDGE DUMPING OFF THE FLORIDA COAST
Washington GPO 1971 94 p refs Hearing before Comm. on Public Works, 91st Congr., 2d Sess., 7 Dec. 1970
Avail: Subcomm. on Air and Water Pollution

Statements and testimony presented to the Subcommittee regarding this major oil spill are documented. Included is a reprint of a report prepared by the Council on Environmental Quality on Ocean Dumping, A National Policy. J.G.M.

N71-35179# Committee on Interstate and Foreign Commerce (U. S. House).
FLAMMABLE FABRICS, 1971
Washington GPO 1971 45 p refs Hearings on H.R. 5066 before Comm. on Interstate and Foreign Com., 92d Congr., Sess., 4-5 Mar. 1971 /ts Serial No. 92-2
Avail: Subcomm. on Com. and Finance

Legislation to curb the loss of life and property due to the inflammability of various textiles is discussed. The legislation applies to all articles of wearing apparel and interior furnishings used in homes, offices and other places of assembly or accomodation. Losses of life and property caused by flammable materials are examined and methods for improving flame resistance of materials are discussed. Author

N71-35180# Committee on Government Operations (U. S. House).
APPLICATION OF AEROSPACE AND DEFENSE INDUSTRY TECHNOLOGY TO ENVIRONMENTAL PROBLEMS
Washington GPO 1970 263 p refs Hearings before Comm. on Govt. Operations, 91st Congr., 2d Sess., 23-24 Nov. 1970
Avail: Subcomm. on Conservation and Nat. Resources

Congressional testimony concerning the use of aerospace and defense industry resources and technology to the solution of problems concerning environmental pollution in presented. Statements made by legislative and technical personnal are published to explain the extent of the problem and to recommend actions for correcting the increasing deterioration of the environment. P.N.F.

N71-35181# Committee on Interior and Insular Affairs (U. S. Senate).
NATIONAL FUELS AND ENERGY POLICY
Washington GPO 1971 133 p refs Hearing on S. Res. 45 before Comm. on Interior and Insular Affairs, 92d Congr., 1st Sess., 25 Feb. 1971
Avail: Comm. on Interior and Insular Affairs

Congressional testimony concerning a study of the nation's energy resources and a review of the body of law and policy which influence the energy situation is presented. Examples of problems throughout the energy system which indicate the need for such an investigation are presented. Statements of law makers from various states are included to define the scope of the problem. P.N.F.

N71-35182# Committee on Public Works (U. S. Senate).
MANPOWER AND TRAINING NEEDS FOR AIR POLLUTION CONTROL
Elliot L. Richardson Washington GPO 1970 48 p Rept. of the Secy. of Health, Educ., and Welfare to the Congr. of the US, Jun. 1970
(S-Doc-91-98) Avail: SOD $0.25

The manpower needs of public and private sectors are surveyed and steps necessary to meet the manpower and training needs in the air pollution control field are described. There is included in the appendix detailed information on non-Federal control agency manpower needs; the salaries paid by state, local, and regional agencies; the vacancy rate of non-Federal control agencies; the manpower needs for air pollution control by the private sector; and training programs available to develop personnel in the air pollution control field. Author

N71-35183# Office of Science and Technology, Washington, D.C.
PROTECTING THE WORLD ENVIRONMENT IN THE LIGHT OF POPULATION INCREASE
Dec. 1970 45 p refs
Avail: SOD $0.50

The international framework for directing attention to environmental questions which will affect the pattern of development on the spaceship Earth for decades to come is discussed. The potential effect of profligate human expansion on living and future generations is investigated. The nations of the world must accept a new responsiblity not only for their own citizens, but also for the effects of their activities on the welfare of all mankind. The fundamental objective must be improving the quality of life throughout the world. Stabilized populations, economic viability, resource conservation and environmental enhancement all contribute to achieving this objective. Author

N71-35184# National Bureau of Standards, Washington, D.C.
MANUFACTURING BUSINESS: US METRIC STUDY Interim Report
June R. Cornog and Elaine D. Bunten Jul. 1971 191 p refs
(NBS-Sp-345-5) Avail: SOD $1.50

This publication, prepared pursuant to the U.S. Metric Study Act, reports on the experiences and views of nonmanufacturing businesses with regard to metric usage and its increase. The study is based on a survey of more than 2500 companies and firms primarily involved in: agriculture, forestry, fisheries, mining, construction, transportation, communications, utilities, wholesale/retail trade (including exporters/importers), finance, insurance, real estate, or services. Information was obtained on: past or present experience with use of the metric system (including perceived advantages and disadvantages thereof), attitudes toward future metrication in a world of increasing metric usage (including preferred U.S. policy regarding), and estimated cost impacts and benefits which would be attendant to a national metrication program. Author

N71-35185# Civil Aeronautics Board, Washington, D.C.
STATEMENT BY THE HONORABLE SECOR D. BROWNE, CHAIRMAN, CIVIL AERONAUTICS BOARD, FOR PRESENTATION TO ATTENDEES OF AN AIR-CARGO CONFERENCE
Secor D. Browne 1971 2 p Conf. held at Seattle, 19 Jan. 1971
Avail: NTIS

Mr. Browne's remarks included comments on the relatively constant rate of growth of the domestic container program, a discussion of the General Cargo Investigation, Docket 22859, and an announcement of a general investigation of airfreight liability and claim rules and practices. J.G.M.

N71-35186# Civil Aeronautics Board, Washington, D.C.
CIVIL AERONAUTICS BOARD REPORTS TO CONGRESS, FISCAL YEAR 1970
Secor D. Browne GPO 1970 137 p refs
Avail: SOD $0.70

Civil Aeronautics Board regulatory action touched virtually every area of the agency's interest in fiscal 1970. The public convenience and necessity is best served by an economically sound industry and the air transport industry, while basically sound, has been assailed of late by a number of problems, including spiraling labor costs, disparity between capacity and demand, demands on capital resources, the high cost of money, inadequacies of the air traffic system, problems of environment and crimes against aircraft. The CAB took on rate and route problems as they evolved in fiscal 1970 and also took several major actions that can be expected to help guide the air transport industry soundly into the '70s. In January 1970, the CAB launched the Domestic Passenger Fare Investigation (DPFI), the first such broad, searching look at passenger fares in more than a decade. Author

N71-35187# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE
23 Aug. 1971 31 p refs Transl. into ENGLISH from Eastern European reports
(JPRS-53877) Avail: NTIS

Advancements in aerospace and medical sciences by several European countries are discussed. Subjects presented are: (1) conditions favorable for cholera in Bulgaria, (2) treatment of bacterial endocarditis with tetrolean, (3) chemical industry computer center, and (4) development of air traffic control radar. Author

N71-35188# RAND Corp., Santa Monica, Calif.
ILS: PREREQUISITE TO IMPROVED OPERATIONAL CAPABILITY
R. M. Paulson and R. B. Weine Mar. 1970 33 p Presented at the Management of Integrated Logistic Support Meetings, Mar. 1970; Sponsored by George Washington Univ. and the Washington Chapter of the Soc. of Logistics Engr.
(P-4318) Avail: NTIS

The development and characteristics of an Integrated Logistic Support system (ILS) are discussed. ILS is a composite of the elements necessary to assure the effective and economical support of a system or equipment at all levels of maintenance for its programmed life cycle. Factors which determine the effectiveness of ILS are: (1) operational capability, (2) availability, (3) dependability, and (4) performance. Author

N71-35189# National Science Foundation, Washington, D.C.
RESEARCH AND DEVELOPMENT IN INDUSTRY, 1969, FUNDS, 1969, SCIENTISTS AND ENGINEERS
Jan. 1970 89 p
(NSF-71-18) Avail: SOD $1.00

The National Science Foundation both conducts and sponsors surveys in the various sectors of the economy to better understand changes in R&D emphasis, as well as to measure the growth, magnitude, and other characteristics of research and development. The data obtained from these surveys are published by the Foundation and are designed to provide information useful to Government officials, legislators, and other individuals concerned with evaluating the role of research and development in furthering the national welfare and in the allocation of scientific resources. The results of the 1969 survey of industrial research and development are presented. Author

N71-35190# Committee on Science and Astronautics (U. S. House).
PANEL ON SCIENCE AND TECHNOLOGY, TWELFTH MEETING: INTERNATIONAL SCIENCE POLICY
Washington GPO 1971 381 p Proc. before the Comm. on Sci. and Astronautics, 92d Congr., 1st Sess., 28-28 Jan. 1971
Avail: US Capitol, House Document Room

The proceedings of the Panel on Science and Technology before the Committee on Science and Astronautics of the U. S. House of Representatives are presented. The theme of the proceedings was expressed as international science policy, viewed as a summation of national policies, international agreements, and voluntary associations between groups of scientists and engineers, plays an increasingly important role in a technological society. The sessions explore the nature of present policies, how the policies can be improved, and ways to more effectively harness the policies for meeting world wide problems. Author

N71-35191# Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information Extension.
BIBLIOGRAPHIES OF ATOMIC ENERGY LITERATURE Progress Report, Jan. - Mar. 1971
Mar. 1971 9 p refs
(TID-3762) Avail: NTIS

Bibliographies of Atomic Energy Literature, presents a series

of bibliographies intended for use as a reference source of available current data on nuclear related topics. Bibliographies in preparation both foreign and domestic are also announced.
Author

N71-35192# Committee on Aeronautical and Space Sciences (U. S. Senate).
NASA AUTHORIZATION FOR FISCAL YEAR 1971
Clinton P. Anderson Washington GPO 1970 120 p
(Rept-91-833) Avail: US Capitol, Senate Document Room

Congressional adjustments to the NASA fiscal year 1970 budget request, legislative history, and a summary of Congressional adjustments to the fiscal year 1971 request are presented. The appropriations for research and development, construction of facilities, research and program management, and space programs of other agencies are reviewed. J.M.

N71-35193# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE. SCIENTIFIC AFFAIRS NO. 192
1 Sep. 1971 53 p refs Transl. into ENGLISH from Eastern European Journals
(JPRS-53960) Avail: NTIS

Brief summaries of European meteorological trips, events, and proceedings are presented. An evaluation of Intercosmos Organization research participation is given as well as comments on international cooperation in nuclear research at Dubna. A discussion of education by suggestion and a description of a system for keeping records on nuclear materials in Hungary are included. The prevention and eradication of anthrax are also discussed. J.M.

N71-35194 Commerce Dept., Washington, D.C.
AIRLINE SERVICE IN THE USA
1971 80 p
Avail: NTIS

A travel agent's guide to air travel in the U.S.A. is presented. Topics discussed include: airlines and route maps, helicopter services, fares, and terminal facilities. F.O.S.

N71-35195 National Lending Library for Science and Technology, Boston Spa (England).
PROBLEMS OF SCIENTIFIC AND TECHNOLOGICAL PROGRESS
A. Rumyantsev 13 Apr. 1971 17 p Transl. into ENGLISH from Voprosy Ekonomiki (USSR), no. 1, 1971
(NLL-M-20415-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Techniques for evaluating and assessing the contributions made by science and technology to the advancement of society are discussed. It is determined that the possibility of enhancing the economic efficiency of production to an ever increasing measure is determined by the advancement of science and technology. Effects of investing in research and development are discussed from a positive and negative aspect of the benefits derived by society. Author

PUBLIC COLLECTIONS OF NASA DOCUMENTS
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N71-351835 Office of Science and Technology, Washington, D.C.
PROTECTING THE WORLD ENVIRONMENT IN THE LIGHT OF POPULATION INCREASE
Dec. 1970 45 p. refs
Avail: SOD $0.50

The international framework for directing attention to environmental questions which will affect the pattern of development on the spaceship Earth for decades to come is discussed. The potential effect of profligate human depletion on living and future generations is investigated. The nations of the world must accept a new responsibility not only for their own citizens, but also for the effects of their activities on the welfare of all mankind. The fundamental objectives must be improving the quality of life throughout the world. Stabilized populations, economic viability, resource conservation and environmental enhancement of contribute to achieving this objective. Author

N71-351845 National Bureau of Standards, Washington, D.C.
MANUFACTURING BUSINESS: US METRIC STUDY
Interim Report
Jane R. Cornog and Elaine G. Bunten Jul. 1971 191 p. refs
(NBS-Sp-345-b) Avail: SOD $1.50

This publication, prepared pursuant to the U.S. Metric Study Act, reports on the experiences and views of nonmanufacturing businesses with regard to metric usage and no increase. The study is based on a survey of more than 2500 companies and firms presently certified in: Agriculture, forestry, fisheries, mining, construction, transportation, communications, utilities, wholesale, retail trade, insurance, exporters/importers, finance, insurance, real estate, or services. Information was obtained on: past or present experience with use of the metric system including perceived advantages and disadvantages thereof, attitudes toward future metrication to a world of increasing metric usage (including preferred U.S. policy regarding), and estimated cost impacts and benefits which would be attendant to a national metrication program. Author

N71-351884 Civil Aeronautics Board, Washington, D.C.
STATEMENT BY THE HONORABLE SECOR D. BROWNE, CHAIRMAN, CIVIL AERONAUTICS BOARD, FOR PRESENTATION TO ATTENDEES OF AN AIRCARGO CONFERENCE
Secor D. Browne 1971 2 p. Conf. held at Seattle, 19 Jan. 1971
Avail: NTIS

Mr. Browne's remarks included comments on the relatively constant rate of growth of the domestic container program, a discussion of the General Cargo Investigation, Docket 22558, and an announcement of a general investigation of airlines' liability and claim rules and practices. J.G.M.

N71-351884 Civil Aeronautics Board, Washington, D.C.
CIVIL AERONAUTICS BOARD REPORTS TO CONGRESS, FISCAL YEAR 1970
Secor D. Browne OPD 1970 107 p. refs
Avail: SOD $0.70

Civil Aeronautics Board regulatory action involved virtually every area of the agency's interest in fiscal 1970. The public convenience and necessity is best served by an environmentally sound industry and the air transport industry, while basically sound, has been deceased of late by a number of problems, including spiraling labor costs, disparity between capacity and demand, demands on capital resources, the high cost of money, inadequacies of the air traffic system, problems of environment and comes against aircraft. The CAB took on rate and route problems as they evolved in fiscal 1970 and also took several major actions that can be expected to help guide the air transport industry equally into the '70s. In January 1970, the CAB launched the Domestic Passenger Fare Investigation (DPFI), the first such broad, searching look at passenger fares in more than a decade. Author

N71-351915 Atomic Energy Commission, Oak Ridge, Tenn. Div. of Technical Information Extension.
BIBLIOGRAPHIES OF ATOMIC ENERGY LITERATURE
Progress Report, Jan. - Mar. 1971
Mar. 1971 8 p. refs
(TID-3782) Avail: NTIS

Bibliographies of Atomic Energy Literature, presents a series

PUBLIC COLLECTIONS OF NASA DOCUMENTS

DOMESTIC

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EUROPEAN

An extensive collection of NASA and NASA-sponsored publications is maintained by the National Lending Library for Science and Technology, Boston Spa, Yorkshire, England. By virtue of arrangements other than with NASA, the National Lending Library also has available many of the non-NASA publications cited in *STAR*. European requesters may purchase facsimile copy or microfiche of NASA and NASA-sponsored documents, those identified by both the symbols "#" and "*", from: ESRO/ELDO Space Documentation Service, European Space Research Organization, 114, av. de Neuilly, 92-Neuilly-sur-Seine, France.

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Interdisciplinary Approach to the Lubrication of Concentrated Contacts (NASA SP–237)

The proceedings of a conference held at Rensselaer Polytechnic Institute, Troy, New York, July 15–17, 1969, and sponsored by NASA. Topics covered were Lubrication of Concentrated Contacts; Elastohydrodynamic Lubrication; Microslip and Creep in Contacts; Constancy of Scoring Temperature; Structure of Liquids; Rheological Behavior of Lubricants; Structure of Solids; Mechanism of Contact Fatigue; Effect of Materials; Effect of Lubricants; Adsorption and Surface Energetics; Chemistry in Concentrated-Conjunction Lubrication; Bearing Design; and Gear Design. *Paperbound.* 600 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C 20402, for $2.50.

Biomedical Research and Computer Applications in Manned Space Flight (NASA SP–5078)

A technology utilization report consisting of a collection of papers not previously available to the general scientific community concerning research into biomedical variables during manned space flight. The methods used for recording, transmitting, and analyzing vital data such as electrocardiograms and electroencephelograms from astronauts in space are described. The handling of such data by computer (with storage and retrieval capabilities) are also reported. The 10 sections included represent contributions from biochemists, biomedical researchers, mathematicians, neurologists, physicians, psychiatrists, psychologists, statisticians, and computer, electronics, and medical engineers. *Paperbound.* 208 pp. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, for $2.00.

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